

Energy Savings Opportunity Survey
Energy Engineering Analysis Program (EEAP)
Fort Campbell, Kentucky

Final Report - Phase I

*Volume 1
Sections 1-4*

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SYSTEMS*corp*

SYSTEMS ENGINEERING AND MANAGEMENT CORPORATION



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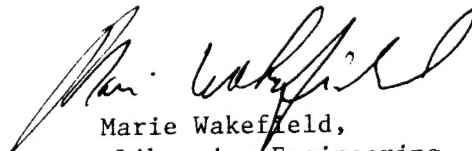


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1 EXECUTIVE SUMMARY

1.1 SYNOPSIS

Systems Corp surveyed and completed energy analyses for 98 buildings, fifteen chiller plants, and roadway lighting. The energy conservation opportunities (ECOs) evaluated were lighting efficiency improvements, instantaneous water heaters, heat recovery from hot refrigerant gases, absorption chiller replacements, and ground water coupled heat pumps. Cost estimates were prepared using M-CACES. Life cycle cost analyses were performed using the Life Cycle Cost in Design (LCCID) computer program. Project development brochures (PDBs) and DD1391 forms were prepared for Energy Conservation Investment Program (ECIP) projects. The projects that were developed represent \$2,257,000 in annual savings with favorable simple paybacks and saving to investment ratios (SIRs).

1.2 INTRODUCTION

Systems Engineering and Management Corporation (Systems Corp) was contracted by the Louisville District of the United States Army Corps of Engineers in June 1993 to perform an energy savings opportunity survey (ESOS) for 98 buildings at Fort Campbell, Kentucky. In addition, the project includes an exterior lighting survey of 5 locations around the facility and a comprehensive survey of 15 chillers serving 57 buildings on the Post.

1.2.1 Scope of Work

1. Evaluated selected energy conservation opportunities (ECOs) to determine their energy savings potential and economic feasibility.
2. Conduct a limited site survey of selected buildings or areas to insure that any methods of energy conservation which are practical and have not been evaluated in any previous energy study have been considered and the results documented.
3. Determine efficiency of existing chillers. Determine the replacement option with the highest SIR.
4. Provide complete programming or implementation documentation for all recommended ECOs.

1 EXECUTIVE SUMMARY

5. Prepare a comprehensive report to document the work performed, the results, and the recommendations.

1.2.2 Organization of the Final Report

The submitted material for this report consists of the following:

Energy Savings Opportunity Survey
Energy Engineering Analysis Program (EEAP)
Fort Campbell, Kentucky

Volume 1: Sections 1 - 4

Volume 2: Section 4 (continued)

Volume 3: Sections 5 - 15

1.3 PRESENT AND HISTORICAL ENERGY CONSUMPTION

The baseline energy consumption and energy conservation opportunity energy consumption were determined using spreadsheets and manual calculating to model system energy consumption. These have been included in *Section 2* of this report.

1.3.1 Natural Gas Costs

The natural gas consumption and cost for the 12 months (July 1992-June 1993) at Fort Campbell are shown in *Table 1.3.1, Fort Campbell Natural Gas*. *Figure 1.3.1* is a bar graph of the monthly consumption and costs. The natural gas cost used for evaluating the ECOs is as follows:

$$\text{COST/MCF} = \$3.41/\text{MCF}$$

$$\text{COST/MBTU} = \$4.00/\text{MBTU}$$

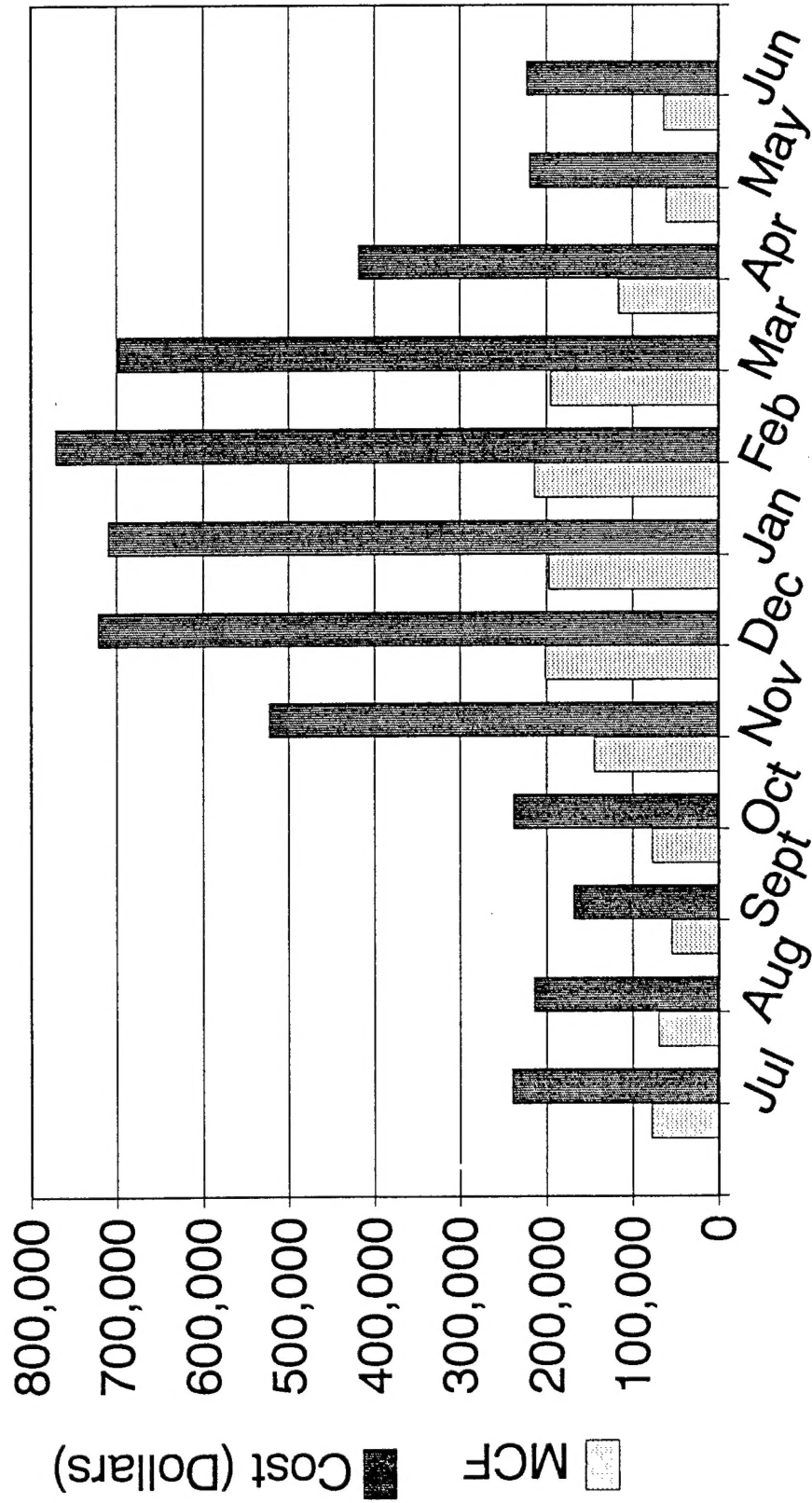
FORT CAMPBELL NATURAL GAS

July 92 - June 93

MONTH	MCF	COST	COST/MCF
Jul 92	77,701	\$239,700	3.08
Aug	69,605	214,724	3.08
Sept	54,771	168,963	3.08
Oct	77,298	238,456	3.08
Nov	145,408	522,621	3.59
Dec	201,521	722,174	3.58
Jan 93	196,833	710,486	3.61
Feb	213,900	771,339	3.61
Mar	195,479	699,147	3.58
Apr	116,968	419,168	3.58
May	60,884	219,255	3.60
Jun	64,113	222,479	3.47
TOTAL	1,474,481	\$5,148,485	3.49
Min	54,771	168,963	3.08
Max	213,900	771,339	3.61
Avg	122,873	429,040	3.41

FORT CAMPBELL ESOS

Natural Gas July 92 - June 93



1 EXECUTIVE SUMMARY

1.3.2 Electric Costs

The electric energy consumption, demand, and costs for the past 12 months (July 1992-June 1993) are shown in *Table 1.3.2 Fort Campbell Electric*. *Figure 1.3.2* is a bar graph of the monthly consumption and cost. The electric cost used to calculate the electric cost savings for the project is as follows:

COST/KWH	=	\$0.02114/KWH (No Demand)
COST/MBTU	=	\$6.19/MBTU (No Demand)
COST/KW	=	\$11.78/KW (Monthly Demand)

1.4 ENERGY CONSERVATION OPPORTUNITIES INVESTIGATED

Systems Corp analyzed five energy conservation opportunities (ECOs) at Fort Campbell, Kentucky. The analysis was performed utilizing energy models developed by Systems Corp and data collected during the field survey of the facilities at Fort Campbell. Each ECO was evaluated to determine the potential energy savings, dollar savings, implementation costs, simple payback, life cycle cost, and savings to investment ratio (SIR). The five ECOs that were evaluated are as follows:

ECO - 1 Instantaneous hot water heaters

ECO - 2 Ground water coupled heat pumps

ECO - 3 Refrigerant heat reclaim

ECO - 4 Replace chillers with high efficiency chillers

ECO - 5 Improve lighting efficiency

Systems Corp's energy analysis models were used to determine the savings achieved for implementing each ECO in the facilities that were evaluated. The U.S Army Corp of Engineers M-CACES software was used to estimate the implementation cost of each ECO in each facility evaluated. The U.S Army Corp of Engineers Life Cycle Cost in Design, Version 1.0, Level 72, software was used to perform life cycle cost analyses and determine the SIR of each ECO for each facility evaluated.

FORT CAMPBELL ELECTRIC

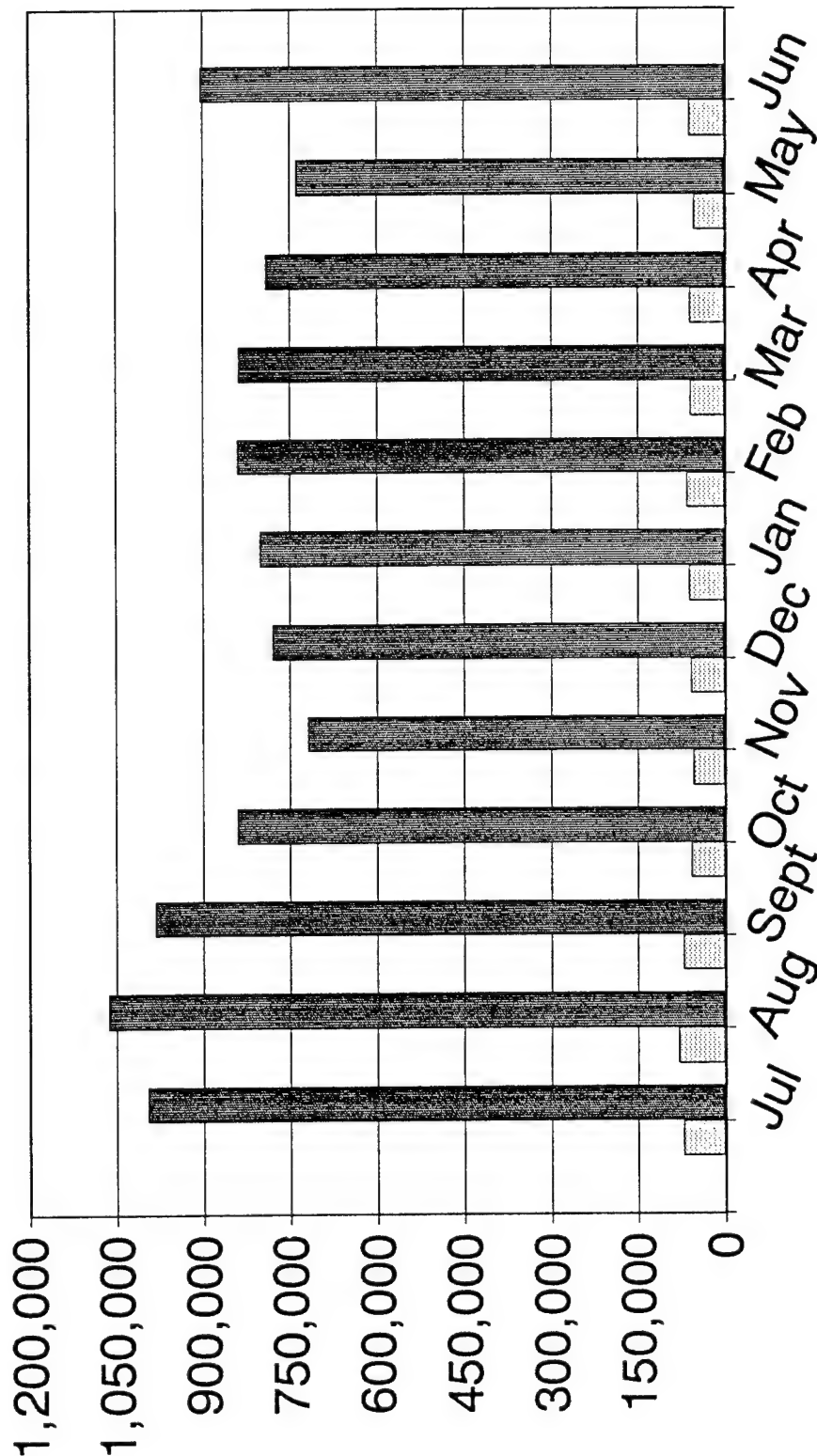
July 92 - June 93

MONTH	DEMAND KW	DEMAND COST	CONSUMPTION KWH	CONSUMPTION COST	COST DEM & CONS	COST/KWH
Jul 92	45,171	\$532,114	21,096,600	\$464,810	\$996,924	.047
Aug	45,927	541,020	23,818,200	523,607	1,064,627	.045
Sept	43,697	514,751	21,319,200	469,265	984,016	.046
Oct	39,425	464,427	17,047,800	376,277	840,704	.049
Nov	31,072	366,028	16,077,600	353,458	719,486	.045
Dec	34,020	400,756	17,287,200	380,190	780,946	.045
Jan 93	33,907	399,424	18,320,400	402,420	801,844	.044
Feb	35,381	416,788	19,307,400	424,019	840,807	.044
Mar	38,140	449,289	17,644,200	388,828	838,117	.048
Apr	33,944	399,860	17,808,000	391,392	791,252	.044
May	34,663	408,330	15,691,200	331,712	740,042	.047
Jun	43,697	514,751	18,429,600	389,601	904,352	.049
TOTAL	459,044	\$5,407,588	223,847,400	\$4,895,579	\$10,303,117	.046
Min	31,072	366,028	15,691,200	331,712	719,486	.044
Max	45,927	541,020	23,818,200	523,607	1,064,627	.049
Avg	38,254	450,628	18,653,950	407,965	858,593	.046

FORT CAMPBELL ESOS

Electric July 92 - June 93

Consumption (MBtu's) ■ Cost (Dollars)



1 EXECUTIVE SUMMARY

1.4.1 ECOs Recommended

Sytems Corp recommended that the following ECOs be implemented due to favorable simple pay backs and savings investment ratios (SIRs).

- ECO - 2 Ground water coupled heat pumps
- ECO - 3 Refrigerant heat reclaim
- ECO - 4 Replace chillers with high efficiency chillers
- ECO - 5 Improve lighting efficiency

1.4.2 ECOs Rejected

ECO-1, Instantaneous Water Heaters, was rejected due to the fact that the potential energy savings was found to be quite small for each building that was evaluated. The implementation costs for each building evaluated did not represent a large investment, but when compared to the savings resulted in simple paybacks in excess of twenty years. Replacing the water heater systems did not yield an acceptable simple payback in any of the buildings evaluated.

1.4.3 ECIP Projects Developed

Systems Corp developed three ECIP projects. The projects include the replacement of 12 absorption chillers serving Korean war era barracks with natural gas engine driven screw chillers, the improvement of lighting efficiency in 38 buildings, and the installation of ground water coupled heat pumps in 770 military family housing units. The project information, including DD1391's, for each project are included in *Sections 3 (Chillers), 4 (Lighting), and 5 (GWCHP)*. The following table summarizes the savings and investment for each project.

TABLE 1.4.3
ECIP PROJECT SUMMARY

		<i>1st Yr Savings</i>	<i>Investment</i>	<i>SIR</i>	<i>SPB (yrs)</i>
ECIP-1	Chillers	\$1,336,609	\$4,115,522	6.87	2.92
ECIP-2	Lighting	\$142,057	\$1,073,612	1.48	7.56
ECIP-3	GWCHP	\$674,606	\$4,837,740	1.15	7.17
	TOTAL	\$2,153,272	\$10,026,874	3.53*	5.47*

*These numbers are weighted averages to show representative values for a total life cycle cost analysis.

1 EXECUTIVE SUMMARY

1.4.4 Non-ECIP Projects Developed

Systems Corp developed 2 projects that did not qualify for ECIP funding due to not meeting the \$300,000 investment criteria. The 2 projects are heat reclaim from hot refrigerant gases at the Commissary and improved lighting efficiency in non-appropriated fund facilities.

TABLE 1.4.4

	1ST YR SAVINGS	INVESTMENT	SIR	SPB
HEAT RECLAIM	\$2,233	\$19,240	1.86	8.62
NAF LIGHTING	12,493	87,822	1.59	7.03
TOTAL	\$14,726	\$107,062	1.63*	7.32*

*These numbers are weighted averages to show representative values for a total life cycle cost analysis.

2 METHODS AND APPROACH

2.1 FIELD SURVEY

The field survey as performed by *SYSTEMS/CORP* was designed to provide the necessary data required to complete the project. It was also designed to provide residual benefits to the installation by providing an organized and readily available source of information which can be used in future years. The information was transmitted in the form of field notes made on standardized survey forms. The field survey forms were submitted with the interim report.

The survey forms were designed to allow notations of all data which could be utilized (not necessarily required) to calculate the energy savings gained by implementing a specific energy conservation opportunity. These forms contain data obtained from as-built drawings and confirmed in the field as well as data obtained only in the field.

2 METHODS AND APPROACH

2.1.1 Buildings

Thorough preparation for the building survey was required to assure that the data required to perform the technical analysis is obtained. The building surveys were performed in a manner which assured the best results. A simple listing of each step of the process best describes our approach to the surveys.

1. The list of ECOs included in the work scope were reviewed in detail.
2. Each ECO was given an identification number which is used consistently throughout this project.
3. An expanded description of each ECO was formulated to outline the possible methods for implementation of the ECO.
4. Survey forms were developed for each ECO to provide space to enter and data which might possibly be used in performing the engineering and economic analysis of the ECO.
5. A list of the types of as-built drawings required for the buildings was prepared based on the information required on the ECO survey forms.
6. A *SYSTEMS/CORP* representative assisted during the survey in gathering the necessary as-built drawings.
7. Due to the age of drawings, it was determined that most required information would need to be gathered during the survey at the buildings.
8. The building surveys were then performed, confirming or revising data obtained from the drawings. Additional data was obtained as required.
9. The Exit Interview was scheduled.

Table 2.1.1.1 is a list of the buildings surveyed sorted by building type.

TABLE 2.1.1.1		
BUILDINGS SURVEYED		
BUILDING TYPE: ADMINISTRATIVE		
BUILDING NUMBER	BUILDING FLOORS	BUILDING AREA
2745	1	13249
3207	1	2551
3210	1	2581
3307	1	2816
3308	1	2257
6254	3	9338
6708	1	2581
6713	1	3610
6715	2	1892
6717	1	2581
6720	1	4892
6723	1	3610
6729	1	3610
6734	1	3610
6735	1	2746
6736	1	2581
6737	1	2581
6738	1	2581
6773	1	2581
6784	1	2581
6789	1	3610
6790	1	3610
6901	3	9303
6904	1	2581
6905	1	2581
6906	1	2581
6907	1	2581
6908	1	2581
6913	1	2581
6914	1	3610
6916	1	2581

TABLE 2.1.1.1		
BUILDINGS SURVEYED		
BUILDING TYPE: ADMINISTRATIVE (CONT.)		
BUILDING NUMBER	BUILDING FLOORS	BUILDING AREA
6924	1	2581
6925	1	3610
6926	1	2581
6932	1	2581
6933	1	3610
6934	1	3610
6935	1	2581
7510	2	14280
7543	1	998

TOTAL AREA THIS TYPE: 170159

TABLE 2.1.1.1**BUILDINGS SURVEYED**

BUILDING NUMBER	BUILDING FLOORS	BUILDING AREA
----------------------------	----------------------------	--------------------------

BUILDING TYPE: ARTS AND CRAFTS		
89	1	11545
TOTAL AREA THIS TYPE: 11545		

BUILDING TYPE: CHILLER PLANT		
6921	1	1470
TOTAL AREA THIS TYPE: 1470		

BUILDING TYPE: CLASSROOM		
5661	1	22480
5740	2	14173
6390	1	12792
6740	1	4141
6744	1	7200
6991	1	3688
6993	1	3688
6995	1	3688
6997	1	3567
TOTAL AREA THIS TYPE: 75417		

BUILDING TYPE: COMMISSARY		
2702	1	104978
TOTAL AREA THIS TYPE: 104978		

BUILDING TYPE: COMMUNICATIONS		
95	3	21864
TOTAL AREA THIS TYPE: 21864		

TABLE 2.1.1.1		
BUILDINGS SURVEYED		
BUILDING NUMBER	BUILDING FLOORS	BUILDING AREA

BUILDING TYPE: CONFERENCE CENTER		
3209	1	3598
TOTAL AREA THIS TYPE: 3598		

BUILDING TYPE: DATA PROCESSING		
7541	1	8908
TOTAL AREA THIS TYPE: 8908		

BUILDING TYPE: DAY CARE CENTER		
4601	1	
TOTAL AREA:		

BUILDING TYPE: GUARD HOUSE		
7574	1	325
TOTAL AREA THIS TYPE: 325		

BUILDING TYPE: LIBRARY		
38	1	16038
TOTAL AREA THIS TYPE: 16038		

BUILDING TYPE: MAINTENANCE SHOPS		
6087	1.5	10768
6302	1	5615
6304	1	5385
6306	1	3108
6308	1	5385
7562	1	1800
TOTAL AREA THIS TYPE: 32061		

TABLE 2.1.1.1**BUILDINGS SURVEYED**

BUILDING NUMBER	BUILDING FLOORS	BUILDING AREA
----------------------------	----------------------------	--------------------------

BUILDING TYPE: MEDICAL		
3208	1	3598
6714	1	2686
6903	1	3867
6915	1	3610
TOTAL AREA THIS TYPE: 13761		

BUILDING TYPE: MUSEUM		
5702	1	14000
TOTAL AREA THIS TYPE: 14000		

BUILDING TYPE: MUSIC		
3202	1	13381
TOTAL AREA THIS TYPE: 13381		

BUILDING TYPE: POST OFFICE		
91	1	12873
TOTAL AREA THIS TYPE: 12873		

BUILDING TYPE: RECREATION		
3411	1	20918
TOTAL AREA THIS TYPE: 20918		

BUILDING TYPE: RELIGIOUS		
7514	1	4064
TOTAL AREA THIS TYPE: 4064		

TABLE 2.1.1.1**BUILDINGS SURVEYED**

BUILDING NUMBER	BUILDING FLOORS	BUILDING AREA
----------------------------	----------------------------	--------------------------

BUILDING TYPE: SIMULATOR		
6088	1	4988
TOTAL AREA THIS TYPE: 4988		

BUILDING TYPE: THEATRE		
93	2	17497
TOTAL AREA THIS TYPE: 17497		

BUILDING TYPE: TRANSPORTATION		
2699	1	3319
TOTAL AREA THIS TYPE: 3319		

BUILDING TYPE: TROOP SERVICES		
6140	1	5867
6902	1	3867
TOTAL AREA THIS TYPE: 9734		

BUILDING TYPE: WAREHOUSE		
5207	1	169375
5210	1	8678
5212	1	10880
5216	1	30000
7855	1	10815
7856	1	9607
TOTAL AREA THIS TYPE: 317385		

2 METHODS AND APPROACH

2.1.2 Exterior Lighting

The exterior lighting survey was performed in much the same way as the building survey. The approach for the exterior lighting survey was to survey the specified locations on the post. A listing of the steps required to complete this task are as follows:

1. The ECO was reviewed in detail and given an identification number.
2. An expanded description of the ECO was formulated to outline the possible methods of implementation.
3. A survey form was developed.
4. Site maps were reviewed and survey locations were identified.
5. A preliminary site survey was performed to establish fixture distances, mounting height and area types.
6. Sketches of the locations and preliminary data were prepared for field notes.
7. Lamp wattage information was obtained from the electrical maintenance staff.
8. A daylight survey of each location was performed to identify fixture and lamp types, wattages and voltages.
9. A nighttime survey was performed to measure light levels at each of the surveyed locations.

Table 2.1.2.1 is a listing of the areas surveyed for exterior lighting.

TABLE 2.1.2.1				
LIST OF EXTERIOR LIGHTING SURVEY LOCATIONS				
AREA NUMBER	AREA NAME	FIXTURES SURVEYED		
		175W MV	400W MV	100W HPS
1	PIERCE VILLAGE	3	66	8
2	LaPOINTE VILLAGE	13	18	2
3	HAMMOND HEIGHTS	0	57	70
4	LEE VILLAGE	4	124	0

2 METHODS AND APPROACH

2.1.3 Family Housing

The survey for family housing consisted of six existing electric heat pumps in four family housing areas. The six units will be used to represent 770 family housing units. During the survey the following information was gathered:

1. Manufacturer, model, and serial numbers for indoor unit.
2. Manufacturer, model, and serial numbers for outdoor unit.
3. Unit Tonnage.
4. Number of similar units in area.

The data gathered was used to establish the energy efficiency ratio (EER) of the units. *Table 2.1.3.1* lists the areas surveyed in family housing.

TABLE 2.1.3.1			
AREAS SURVEYED FOR ECO - 2: GROUND WATER COUPLED HEAT PUMPS			
AREA NUMBER	AREA NAME	BUILDING NUMBER	UNIT TYPE
1	La POINTE VILLAGE	4233	4 OR 6
2	HAMMOND HEIGHTS	4980	3 OR 4
3	DRENNON PARK	1153	DUPLEX
3	DRENNON PARK	1164	SINGLE

2.1.4 Chillers

The survey of the chillers consisted of fifteen single stage steam driven absorption chillers serving the Korean War era barracks in the 3200, 6700 and 6900 areas. During the survey the following information was gathered by on-site visual inspections, review of maintenance records, review of design documents, review of manufacturers submittals and measurements of operating characteristics.

1. Manufacturer, model and serial numbers.
2. Steam pressure and flow.
3. Condenser water flow, pressure drop and temperature rise.
4. Chilled water pump data.
5. Condenser water pump data.

The data gathered was used to determine the current operating characteristics of the existing chillers including the coefficients of performance. The data collected was more than adequate to evaluate the energy conservation opportunities.

Table 2.1.4.1 lists the buildings surveyed for chiller replacement.

TABLE 2.1.4.1

CHILLERS SURVEYED FOR ECO - 4:
 REPLACE ABSORPTION CHILLERS WITH HIGH EFFICIENCY UNITS

BUILDING NUMBER	BUILDING FLOORS	BUILDING AREA	CHILLER CAPACITY (TONS)	YEAR INSTALLED
3213	3	42627	140	1979
3214	3	42647	250	1977
6711	3	38329	360	1976
6718	3	31869	140	1976
6726	3	38160	360	1976
6732	3	38442	300	1976
6774	3	31953	90	1976
6776	3	38152	320	1977
6781	3	37904	320	1975
6910	3	38089	320	1975
6921A	1	1470	570	1975
6929	3	38281	320	1975
6936	3	31735	160	1975
6938	3	38039	320	1975
6944	3	38063	380	1974

TOTALS: 525740 4350

2 METHODS AND APPROACH

2.2 CALCULATIONS

Energy calculations were performed using both manual and computerized techniques. Due to the large volume of calculations to be performed using both methods, standardized procedures were developed for both computer models and the hand calculated models. This assured consistent results and uniformity of quality in all of the calculations performed.

2.2.1 Baseline Energy Consumption

The following sections will describe the method for calculating the baseline energy consumption for each of the five ECOs.

2.2.1.1 Baseline Energy Consumption: ECO - 1 (Instantaneous Water Heaters)

The baseline energy consumption for this ECO was calculated by developing a LOTUS123 spreadsheet which represented all areas of energy consumption. The following areas represent the major sources of energy consumption for the current domestic hot water system:

1. Consumption - the initial heating of the inlet cold water.
2. Storage losses - heat loss from storage tank.
3. Line losses - heat loss from hot water lines.
4. Temperature - additional energy consumption due to improper temperature setting.

These items were calculated using manufacturer's data and measurements taken in the field.

Table 2.2.1.1.1 lists the baseline energy consumption for this ECO.

TABLE 2.2.1.1.1
BUILDING BASELINE ENERGY CONSUMPTION
ECO - 1: INSTANTANEOUS WATER HEATERS

BUILDING NUMBER	BASELINE ENERGY CONSUMPTION (MBTU)	BUILDING NUMBER	BASELINE ENERGY CONSUMPTION (MBTU)
38	448.95	6308	90.51
89	154.42	6390	211.91
91	332.36	6708	57.29
95	316.44	6713	49.31
2699	72.77	6714	43.64
2745	194.07	6715	176.50
3202	322.85	6717	32.40
3207	55.76	6720	127.32
3208	2.31	6723	52.08
3209	16.78	6729	45.38
3307	52.81	6734	5.24
3308	26.14	6735	N/A
3411	158.00	6736	4.38
4601	5.24	6737	5.66
5207	1841.08	6738	2.99
521	11.14	6740	N/A
5212	56.78	6744	N/A
5216	3.59	6773	3.15
5661	392.87	6784	5.79
5702	90.34	6789	3.62
5740	26.00	6790	1.23
6087	742.42	6901	11.57
6088	174.38	6902	13.77
6140	70.92	6904	2.84
6254	200.57	6905	N/A
6302	59.44	6906	N/A
6306	59.55	6907	3.04
6306	76.80	6908	2.68

TABLE 2.2.1.1.1 BUILDING BASELINE ENERGY CONSUMPTION ECO - 1: INSTANTANEOUS HOT WATER HEATERS	
BUILDING NUMBER	BASELINE ENERGY CONSUMPTION (MBTU)
6913	4.17
6914	2.80
6915	3.85
6916	1.81
6924	4.58
6924	4.58
6924	3.31
6924	3.31
6925	3.79
6926	2.83
6932	N/A
6934	5.70
6935	6.79
6991	N/A
6993	2.45
6995	2.57
6997	3.91
7510	327.11
7855	N/A
7856	N/A

TOTAL MBTU: 7300.64

2 METHODS AND APPROACH

2.2.1.2 Baseline Energy Consumption: ECO - 2 (Ground Water Coupled Heat Pumps)

The baseline energy consumption for this ECO was calculated using a LOTUS123 spreadsheet. This spreadsheet modeled the energy consumption of the existing electric heat pumps. The energy consumption was modeled using manufacturer's data on the existing units and weather bin data. The baseline consumption was calculated for all the different unit types and sizes by utilizing different values of EERs for the different units. The following table lists the baseline for each family housing area.

TABLE 2.2.1.2.1 BASELINE ENERGY CONSUMPTION ECO - 2 GROUND HEAT PUMPS		
AREA NUMBER	AREA NAME	BASELINE ENERGY CONSUMPTION (MBTU)
1	La POINTE	13181
2	HAMMOND HEIGHTS	26363
3	DRENNON PARK	21044
3	DRENNON PARK	925

TOTAL MBTU: 61513

2.2.1.3 Baseline Energy Consumption: ECO - 3 (Refrigerant Heat Reclaim)

The baseline energy consumption for this ECO was calculated by hand. The recovered heat from the refrigeration equipment will be used to heat domestic hot water. The baseline energy consumption therefore is the energy consumed by the existing water heaters.

Building 2702 298 MBTU

2 METHODS AND APPROACH

2.2.1.4 Baseline Energy Consumption: ECO - 4 (Replace Absorption Chillers with High Efficiency Units)

The baseline energy consumption for this ECO was calculated using a LOTUS123 spreadsheet. This spreadsheet modeled the energy consumption of the existing chillers by utilizing manufacturer's data (COP of the unit), field measurements, and weather bin data. The following table lists the baseline energy consumption for each building.

TABLE 2.2.1.4.1		
CHILLER BASELINE ENERGY CONSUMPTION		
ECO - 4: REPLACE CHILLERS WITH HIGH EFFICIENCY UNITS		
BUILDING NUMBER	BUILDING AREA	BASELINE ENERGY CONSUMPTION (MBTU)
3213	42627	21527
3214	42627	21527
6711	38329	24212
6718	31829	11811
6726	38160	24212
6732	38442	24212
6774	31953	15497
6776	38152	42637
6781	37904	42637
6910	38089	40669
6921	1470	58890
6929	38281	42637
6936	31735	15102
6938	38039	42637
6944	38063	39149
TOTALS:	525740	467356

2 METHODS AND APPROACH

2.2.1.5 Baseline Energy Consumption: ECO - 5 (Improve Lighting Efficiency)

The baseline energy consumption for this ECO was calculated using a LOTUS123 spreadsheet. This spreadsheet modeled the energy consumption of the existing lighting system by utilizing the following:

1. Existing fixture type (i.e. fluorescent, mercury vapor, etc.)
2. Lamp wattage
3. Ballast wattage
4. Hours of use

The above information was obtained during the field survey.

Table 2.2.1.5.1 lists the baseline consumption for each building surveyed. *Table 2.2.1.5.2* lists the baseline consumption for the exterior locations surveyed.

TABLE 2.2.1.5.1

**BUILDING BASELINE
ENERGY CONSUMPTION
ECO - 5: IMPROVE LIGHTING EFFICIENCY**

BUILDING NUMBER	BASELINE ENERGY CONSUMPTION (MBTU)
38	488.95
89	154.42
91	332.36
95	316.44
2699	72.77
2745	194.07
3202	322.85
3204	26.67
3206	16.32
3207	55.76
3209	16.78
3307	52.81
3308	26.14
3411	158.00
5207	1841.08
5212	56.78
5661	392.87
5702	90.34
5740	26.00
6087	742.42
6088	174.38

BUILDING NUMBER	BASELINE ENERGY CONSUMPTION (MBTU)
6140	70.92
6254	200.57
6302	59.44
6304	59.55
6306	76.8
6308	90.51
6390	211.91
6708	57.29
6713	49.31
6714	43.64
6715	176.50
6717	32.40
6720	127.32
6723	52.08
6729	45.38
7510	327.11
7514	2.76
7541	307.26
7543	5.59
7562	4.61
7574	1.06

TOTAL MBTU: 7520.21

TABLE 2.2.1.5.2		
EXTERIOR LIGHTING BASELINE ENERGY CONSUMPTION		
AREA NUMBER	AREA NAME	BASELINE ENERGY CONSUMPTION (MBTU)
1	PIERCE VILLAGE	543
2	La POINTE	193
3	HAMMOND HEIGHTS	459
4	LEE VILLAGE	1014

TOTAL: 2209

2 **METHODS AND APPROACH**

2.3 **ENERGY CONSERVATION OPPORTUNITIES**

Systems Corp analyzed five distinct energy conservation opportunities (ECOs) at Fort Campbell, Kentucky. The analysis was performed utilizing energy models developed by Systems Corp and data collected during the field survey of the facilities at Fort Campbell. Each ECO was evaluated to determine the potential energy savings, dollar savings, implementation costs, simple payback, life cycle cost and savings to investment ratio (SIR). The five ECOs that were evaluated are as follows:

- ECO - 1 Instantaneous hot water heaters
- ECO - 2 Ground water coupled heat pumps
- ECO - 3 Refrigerant heat reclaim
- ECO - 4 Replace chillers with high efficiency chillers
- ECO - 5 Improve lighting efficiency

Systems Corp's energy analysis models were used to determine the savings achieved for implementing each ECO in the facilities that were evaluated. The U.S Army Corp of Engineers M-CACES software was utilized to estimate the implementation cost of each ECO in each facility evaluated. The U.S Army Corp of Engineers Life Cycle Cost in Design, Version 1.0, Level 72, software was used to perform life cycle cost analyses and determine the SIR of each ECO for each facility evaluated.

2.3.1 **ECO - 1: Instantaneous Water Heaters**

This ECO evaluation consisted of selecting a replacement water heating system to evaluate for energy savings. The water demand characteristics of each building were considered. In all buildings studied it was determined that semi-instantaneous water heaters were the best replacement option. Replacement of the existing water heater with a new semi-instantaneous water heater was evaluated for each building. The potential energy savings was found to be quite small for each building that was evaluated. The implementation costs for each building evaluated did not represent a large investment, but when compared to the savings resulted in simple paybacks in excess of twenty years. Replacing the water heater systems did not yield an acceptable simple payback in any of the buildings evaluated.

2 METHODS AND APPROACH

The reasons for the retrofits yielding poor simple paybacks were the size of the water heating systems that were evaluated, and the hot water demand and consumption characteristics of the facilities studied. Systems Corp recommends for future studies that instantaneous and semi-instantaneous water heaters only be considered in facilities that would meet this criteria such as hospitals, dining halls, laundries, gymnasiums, and some barracks.

2.3.2 ECO - 2: Ground Water Coupled Heat Pumps

The ECO evaluation consisted of selecting a ground water heat pump and a system configuration to evaluate. A ground water coupled heat pump with a seasonal energy efficiency rating (SEER) of 14 was selected for evaluation. The system configuration consisted of a one for one replacement of heat pumps; and separate supply and return wells serving every two heat pumps. Bin weather data was utilized in a spreadsheet format to model the annual energy consumption of both the existing system and the proposed systems. The most significant cost for the groundwater coupled heat pump is the well systems. The project did not have an attractive simple payback when evaluated with a dedicated supply and return well for each heat pump.

2.3.3 ECO - 3: Heat Reclaim from Hot Refrigerant Gas

The ECO evaluation consisted of quantifying the available heat that was recoverable and determining the best use of the heat. The heat is recovered from the hot suction gases after they leave before the gases pass through the condensing units. The heat is recovered in a shell and tube heat exchanger. The system consists of four heat exchangers. Two of the heat exchangers add heat to a circulating loop that serves restrooms and the employee break area. The other two heat exchangers add heat to the circulating loop that serves the produce, meat and other food processing areas.

2.3.4 ECO - 4: Replace Absorption Chillers with High Efficiency Units

The ECO evaluation consisted of evaluating four different alternatives for replacing the existing single stage absorption chillers with high efficiency chillers. The alternatives that were evaluated included: single stage absorption, two stage absorption, electric centrifugal, and natural gas engine driven screw chillers. The natural gas engine driven screw chillers provided the quickest simple payback and the highest savings to investment ratio.

2.3.5 ECO - 5: Improve Lighting Efficiency

The ECO evaluation consisted of determining appropriate lighting replacements to improve lighting system efficiency while achieving recommended illumination levels. The ECO includes comprehensive lighting replacements.

TABLE 2.3.5.1	
LIGHTING SYSTEM REPLACEMENTS	
ECO 5	
EXISTING LIGHTING	REPLACEMENT LIGHTING

T-12 Fluorescent Fixture	T-8 Fluorescent Fixture with reflector
T-12 Lamp	T-8 Lamp
Magnetic Ballast	Electronic Ballast

Incandescent Fixture	Compact Fluorescent Fixture
Incandescent Lamp	Compact Fluorescent Lamp and Ballast
Incandescent Exit Sign	LED (Light Emitting Diode) Exit Sign

Mercury Vapor Fixture	High Pressure Sodium Fixture
Mercury Vapor Ballast	Electronic Ballast
Mercury Vapor Lamp	High Pressure Sodium Lamp

The lighting replacements are for administrative, warehouse, maintenance, and retail facilities and roadway lighting.

SECTION 3

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BUILDING 6732	3-109
BUILDING 6910	3-125
BUILDING 6921A	3-141
BUILDING 6929	3-157
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3 PROGRAMMING DOCUMENT - ECIP PROJECT 1

The ECO evaluation consisted of evaluating four different alternatives for replacing the existing single stage absorption chillers with high efficiency chillers. The alternatives that were evaluated included: single stage absorption, two stage absorption, electric centrifugal, and natural gas engine driven screw chillers. The natural gas engine driven screw chillers provided the quickest simple payback and the highest savings to investment ratio.

This section contains the programming documentation for ECIP Project 1, replacement of absorption chillers with natural gas engine driven chillers. Included are the project development brochures, 1391 forms, life cycle cost analysis, cost estimates for each building, and energy calculations for each building. Catalog cut sheets are included as an appendix to the document (located at the end of this section) to represent the replacement products.

The life cycle cost analysis sections 3A and 3B refer to non-energy savings or costs present. For this project, Section 3A, Annual Recurring, reflects the additional maintenance costs associated with the use of natural gas engines. Section 3A, Non-Recurring Savings/Costs, refers to the eventual replacement of the existing chillers. Since the existing chillers are at the end of their economic life, it was assumed that they would be replaced with a similar system, another single stage absorption unit.

The project results presented in this section differ from the results presented in the interim report. Buildings 6774, 6776, and 6781 were removed from the project because they are scheduled for demolition within five years.

facility

Chiller Replacements

Fort Campbell, Kentucky

project coordinator for using service

Arlin Wright

functional requirements summary, PDB-1

3-2

OBJECTIVE:

The objective of this project is to replace existing single stage absorbtion chillers with higher efficiency natural gas engine chillers. The replacement of the existing chillers will reduce energy consumption and life cycle operating costs for the subject facilities in accordance with the Army Energy Resources Management Plan (ERMP) and Executive Order 12759.

[illegible]

3-4

APPENDIX C
DOCUMENTATION CHECKLIST

A. SPECIAL CONSIDERATIONS

ITEM	
A-1	Cost estimates for each primary and supporting facility
A-2	Telecommunications system coordination with USACC and authorization for exceptions
A-3	Coordination with state and local governmental requirements (blind vendors, medical facilities, construction and operating permits, clearinghouse coordination, etc.)
A-4	Assignment of airspace
A-5	Economic analysis of alternatives
A-6	Approval for new starts
A-7	International balance of payments (IBOP) coordination with U.S. European command and NATO—overseas cost estimates and comparables (include rate of exchange used in estimates)
A-8	Impact on historic places—on site survey by authorized archeologist and coordination with state historic preservation officer and advisory council on historic preservation
A-9	Exceptions to established criteria
A-10	Coordination with various staff agencies (Provost Marshall-physical security, etc.)
A-11	Identification of related or support projects (so projects can be coordinated)
A-12	Required completion date
Other Special Considerations (List and number items)	
1. See Appendix A	

Required or Not Required	To Be Determined	Comment Attached	Document Attached
R	D		1
NR			
R	A		
NR			
R	D		
NR			
NR			
NR			
NR			
R			
R			
R			

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

***BY WHOM** (Check and insert appropriate letter)

- A — DFAE
- B — Using Service
- C — Construction Service
- D — Designer
- E — Other (Check Comments Attached and explain)

documentation checklist

3-6

B. SITE DEVELOPMENT

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
B-1	Consultation with the District Office to determine and evaluate flood plain hazards	NR			
B-2	Preparation, submission, and/or approval of new	NR			
(A)	General Site Plan	NR			
(B)	Annotated General Site Plan	NR			
(C)	Sketch Site Plan	NR			
(D)	Facilities Requirements Sketch	R			
B-3	Preparation of	NR			
(A)	Site Survey	NR			
(B)	Subsoil information	NR			
B-4	Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan	NR			
Other Site Development Considerations (List and number items)					
1. See Project Development Brochure, PDB-1/2					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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A — DFAE

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E — Other (Check Comments Attached and explain)

documentation checklist

3-7

C. ARCHITECTURAL & STRUCTURAL

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
C-1	Reconciliation with troop housing programs and requirements	NR			
C-2	Evaluation of existing facilities (including degree of utilization)	R	D		1
C-3	Approval for removal and relocation of existing useable facilities	NR			
C-4	Evaluation of off-post community facilities	NR			
C-5	Storage and maintenance facilities (including nuclear weapons)	NR			
C-6	Coordination hospitals, medical and dental facilities with Surgeon General	NR			
C-7	Coordination of aviation facilities with FAA	NR			
C-8	Coordination air traffic control and navigational aids with USACC	NR			
C-9	Tabulation of types and numbers of aircraft	NR			
C-10	Evaluation of laboratory, research and development, and technical maintenance facilities	NR			
C-11	Coordination chapels with Chief of Chaplains	NR			
C-12	Review food service facilities by USATSA	NR			
C-13	Automated data processing system or equipment approvals—cost analysis when ADP and/or communication centers not co-located with related facilities	NR			
C-14	Coordination postal facilities with U.S. Postal Service Regional Director	NR			
C-15	Laundry and dry cleaning facilities coordination with ASD(I&L)	NR			
C-16	Tenant facilities coordination with installation where sited	NR			
C-17	Facilities for or exposed to explosions, toxic chemicals, or ammunition—review by DDESB (See also Item B-4)	NR			
C-18	Analysis of deficiencies	R	D		1
C-19	Consideration of alternatives	R	D		2
C-20	Determination whether occupants will include physically handicapped or disabled persons	NR			
C-21	As-build drawings for alterations or additions	R	C		
C-22	Availability of Standard Design or site adaptable designs	NR			
Other Architectural & Structural (List and number items)					
1. See Supplemental Data Detailed Project Justification Paragraph D3.					
2. See Supplemental Data Detailed Project Justification Paragraph D4.					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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- D — Designer
- E — Other (Check Comments Attached and explain)

documentation checklist

3-8

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
D-1	Fuel considerations and cost comparison analysis	R	D		
D-2	Energy requirements appraisal (ERA)	R	D		1
D-3	Conformance with DOD Energy Reduction requirements	R	D		
D-4	Evaluation of existing and/or proposed utility systems	R	D		
Other Mechanical and Utility Systems (List and number items)					
1. See Special Requirements, Paragraph 3 (SRP-3)					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

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A — DFAE

B — Using Service

C — Construction Service

D — Designer

E — Other (Check Comments Attached and explain)

documentation checklist

3-9

E. ENVIRONMENTAL CONSIDERATIONS

ITEM		Required or Not Required	* To Be Determined	Comment Attached	Document Attached
E-1	Environmental impact assessment	R	D		1
E-2	EIA conclusions require Environmental Impact Statement	NR			
E-3	Determination of health, environmental or related hazards. Assistance to determine existence of any health, environmental or related hazard may be requested from Aberdeen Proving Ground, MD 21010, the Office of the Surgeon General, Attn: DASG-HCH (Army Environmental Hygiene Agency)	NR			
E-4	Air/water pollution permit, coordination with agencies and compliance with standards at Federal, state and local level	NR			
E-5	Corrective measures associated with Environmental Impact Statements or assessment—list separately and evaluate.	NR			
<p>Other environmental considerations (list and number items)</p> <p>1. See Supplemental Data Detailed Project Justification Paragraph D9.</p>					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

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A — DFAE

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C — Construction Service

D — Designer

E — Other (Check Comments Attached and explain)

documentation checklist

3-10

APPENDIX D
TECHNICAL DATA CHECKLIST

A. SPECIAL CONSIDERATIONS

ITEM	
A-1	Factors of risk, restriction or unusual circumstance expected to increase costs beyond applicable area averages
A-2	Construction phasing requirements
A-3	Functional support equipment (mechanical, electrical, structural, and security) to be built in
A-4	Equipment in place and justification
A-5	Other equipment and furniture (O&MA, OPA) and costs
A-6	Special studies and tests (hazards analyses, compatibility testing, new technology testing, etc.)
A-7	Type of construction (permanent, temporary, semi-permanent)
A-8	Government furnished equipment (quantities, procurement time, availability and special handling and storage requirements). Funds used for procurement.
Other special considerations (list and number items)	

Required or Not Required	To Be Determined	Comment Attached	Document Attached
NR			
R	D		
NR			
NR			
NR			
NR			
NR			
NR			

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

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DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

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A — DFAE

B — Using Service

C — Construction Service

D — Designer

E — Other (Check Comments Attached and explain)

technical data checklist

3-12

B. SITE DEVELOPMENT

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
B-1	Construction restrictions or guidelines pertaining to site access and preferred construction routes	R	A		
(A)					
(B)	Airfield clearance, explosive storage, working hours, safety, etc.	NR			
(C)	Facilities and/or functions or adjoining areas (structures, materials, impact)	R	A		
B-2	Real estate actions (acquisition, disposal, lease, right-of-way)	NR			
B-3	Demolition/relocation required (data)				
(A)	Special considerations due to explosives/radioactivity/chemical contamination/asbestos emissions/toxic gases	R	A	1	
(B)	Restrictions on disposal of demolished/relocated material including hazardous waste	NR			
B-4	Pavement types and requirements (including traffic surveys and MTMC coordination)	NR			
B-5	Landscape considerations				
(A)	Protection of existing vegetation	R	A		
(B)	Stockpile topsoil	NR			
Other Site Development (List and number items)					
1. There is a possibility that the existing pipe or chiller insulation may contain asbestos.					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

***BY WHOM** (Check and insert appropriate letter)

A — DFAE

B — Using Service

C — Construction Service

D — Designer

E — Other (Check Comments Attached and explain)

technical data checklist

3-13

C. ARCHITECTURAL & STRUCTURAL

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
C-1	Vibration-producing equipment requiring isolation	R	D		
C-2	Seismic zone and other design load criteria (typhoon, hurricane, earthquake loads, high or low loss potential)	NR			
C-3	Protective shelter evaluation and resistant design criteria (conventional/nuclear blast and radiation, chemical/biological)	NR			
C-4	Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, permafrost areas, soil bearing)	NR			
C-5	Designation and strength of units to be accommodated	NR			
C-6	Requirements and data for special design projects	NR			
C-7	Unusual floor and roof loads (safes, equipment)	NR			
C-8	Security features (arms rooms, vaults, interior secure areas)	NR			
Other Architectural & Structural (List and number items)					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*** BY WHOM** (Check and insert appropriate letter)

A — DFAE

B — Using Service

C — Construction Service

D — Designer

E — Other (Check Comments Attached and explain)

technical data checklist

3-14

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

ITEM		Required or Not Required	* To Be Determined	Comment Attached	Document Attached
D-1	Special mechanical requirements or considerations (elevator, crane, hoist, etc.)	NR			
D-2	Special peak usage periods and peak leveling techniques	NR			
D-3	Maintenance considerations (accessibility of equipment, compatibility with existing equipment)	R	D		
D-4	Plumbing—availability, general system type and characteristics (proposed and/or existing, incl. compressed air and gas)	R	D		
D-5	Heating—availability, general system type and characteristics (proposed and/or existing)	NR			
D-6	Ventilating, air condition/refrigeration—availability, general system type and characteristics (proposed and/or existing)	R	D		
D-7	Electrical—availability, general system type and characteristics incl. airfield lighting, communication, etc. (proposed and/or existing)	NR			
D-8	Water supply/waste treatment—availability, general system type and characteristics (proposed and/or existing)	NR			
D-9	Energy requirements/fuel conversion (sources, availability, loads, types of fuel, etc.)	R	D		
D-10	Solar energy evaluation	NR			
	Other Mechanical & Utility Systems (List and number items)				

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*** BY WHOM** (Check and insert appropriate letter)

A — DFAE

B — Using Service

C — Construction Service

D — Designer

E — Other (Check Comments Attached and explain)

technical data checklist

3-15

E. ENVIRONMENTAL CONSIDERATIONS

ITEM		Required or Not Required	To Be * Determined	Comment Attached	Document Attached
E-1	Waste water treatment, air quality, and solid waste disposal criteria	NR			
	Other Environmental Considerations (List and number items)				

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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***BY WHOM** (Check and insert appropriate letter)

- A — DFAE
- B — Using Service
- C — Construction Service
- D — Designer
- E — Other (Check Comments Attached and explain)

technical data checklist

3-16

F. FIRE PROTECTION

ITEM		Required or Not Required	To Be * Determined	Comment Attached	Document Attached
F-1	Special fire protection systems or features (detection and suppression equipment, hazards, etc.)	NR			
	Other Fire Protection Considerations (List and number items)				

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*** BY WHOM** (Check and insert appropriate letter)

- A — DFAE
- B — Using Service
- C — Construction Service
- D — Designer
- E — Other (Check Comments Attached and explain)

technical data checklist

3-17

1. COMPONENT ARMY	FY 19 <u>94</u> MILITARY CONSTRUCTION PROJECT DATA			2. DATE 06 October 93	
3. INSTALLATION AND LOCATION Fort Campbell, Kentucky			4. PROJECT TITLE CHILLER REPLACEMENT		
5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER ECIP #1	8. PROJECT COST (\$000) \$3900		
9. COST ESTIMATES					
ITEM		U/M	QUANTITY	UNIT COST	COST (\$000)
Primary Facility					
Natural Gas Engine Driven Screw Chillers, Piping, Direct Digital					
Controls and Wiring		Lot	1	3,350,000	3,350
Subtotal					3,350
Contingency (10%)					350
Total Contract Cost					3,700
Supervision, Inspection and Overhead (5.0%)					200
Total Request					3,900
10. DESCRIPTION OF PROPOSED CONSTRUCTION The existing chillers are single stage absorption. The existing chillers are inefficient and not cost effective. The proposed project will replace the existing chillers with natural gas engine driven chillers. The implementation of this project will save 301,490 Mbtu/Yr of natural gas energy. The first year savings is \$1,336,609 and the Savings to Investment Ratio (SIR) is 6.5.					
11. REQUIREMENT Project: The proposed project replaces twelve (12) existing single stage absorption chiller with twelve new natural gas engine driven chillers. Requirement: The project is required to reduce the energy consumption of chillers and to comply with the Army Energy Resources Management Plan (ERMP) and Executive Order 12759. The proposed project will reduce annual energy consumption by 301,490 Mbtu/YR and annual energy cost by \$1, 336,609. Current Situation: The existing chiller plants in building numbers 3213, 3214, 6711, 6718, 6726, 6732, 6910, 6921A, 6929, 6936, 6938, 6944, are single stage absorption chillers. The chillers are an inefficient cooling source. The chiller were installed over a four year period starting in FY74.					

1. COMPONENT ARMY	FY 19 <u>94</u> MILITARY CONSTRUCTION PROJECT DATA	2. DATE 06 October 93									
3. INSTALLATION AND LOCATION Fort Campbell, Kentucky											
4. PROJECT TITLE CHILLER REPLACEMENT		5. PROJECT NUMBER ECIP #1									
<p>Impact if not provided: If the proposed project is not funded, a reduction of 301,490 MBtu/YR cannot be achieved, and excessive amounts of energy will continue to be used. There will be no contribution to energy reduction goals established for United States Army facilities by Army Headquarters.</p> <p style="text-align: center;">_____ Colonel, USA Commanding</p> <table> <tr> <td>ESTIMATED CONSTRUCTION START:</td> <td>September 1994</td> <td>INDEX:</td> </tr> <tr> <td>ESTIMATED MIDPOINT OF CONSTRUCTION:</td> <td>April 1995</td> <td>INDEX:</td> </tr> <tr> <td>ESTIMATED CONSTRUCTION COMPLETION:</td> <td>November 1995</td> <td>INDEX:</td> </tr> </table> <p style="text-align: center;">DETAILED JUSTIFICATIONS</p> <p>D1. GENERAL</p> <p>The proposed project encompasses the replacement of fifteen (15) single stage absorption chillers with natural gas engine driven chillers. The project will decrease the energy consumption of the cooling systems without reducing the level of cooling.</p> <p>D2. ACCOMMODATIONS NOW IN USE:</p> <p>The existing cooling systems are comprised of fifteen (15) single stage absorption chillers.</p> <p>D3. ANALYSIS OF DEFICIENCY:</p> <p>Currently, twelve (12) single state absorption chillers are used to cool a number of barracks. The chillers have low coefficients of performance (COP). The purpose of this project is to replace the existing chillers with new chillers that have a much higher coefficient of performance (COP) and are thus, more energy efficient. The current deficiency results in large amounts of energy usage to maintain adequate cooling for comfort.</p>			ESTIMATED CONSTRUCTION START:	September 1994	INDEX:	ESTIMATED MIDPOINT OF CONSTRUCTION:	April 1995	INDEX:	ESTIMATED CONSTRUCTION COMPLETION:	November 1995	INDEX:
ESTIMATED CONSTRUCTION START:	September 1994	INDEX:									
ESTIMATED MIDPOINT OF CONSTRUCTION:	April 1995	INDEX:									
ESTIMATED CONSTRUCTION COMPLETION:	November 1995	INDEX:									

1. COMPONENT ARMY	FY 19 <u>94</u> MILITARY CONSTRUCTION PROJECT DATA	2. DATE 06 October 93
3. INSTALLATION AND LOCATION Fort Campbell, Kentucky		
4. PROJECT TITLE CHILLER REPLACEMENT		5. PROJECT NUMBER ECIP #1
<p>D4. CONSIDERATION OF ALTERNATIVES:</p> <p>The only alternatives to proposed project are to install lower efficiency absorption chillers. The disadvantages of using lower efficiency absorption chillers is that less energy savings can be realized without significantly reducing the construction cost. If a less efficient chiller is selected, the project would have a lower SIR.</p> <p>D5. CRITERIA FOR PROPOSED PROJECT:</p> <p>The proposed project will conform with all applicable federal and United States Army Regulations.</p> <p>D6. PROGRAM FOR RELATED EQUIPMENT:</p> <p>No equipment funded from appropriations other than MCA are required.</p> <p>D7. DISPOSAL OF PRESENT ASSETS:</p> <p>Twelve (12) single state absorption chillers will be disposed.</p> <p>D8. SURVIVAL FACILITIES:</p> <p>The proposed project is not suitable for inclusion of protective shelters.</p> <p>D9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES:</p> <p>The proposed project has been analyzed and will not adversely impact the environment. Energy savings resulting from the project will conserve natural resources.</p> <p>D10. EVALUATION OF FLOOD HAZARDS AND ENCROACHMENT ON WETLANDS:</p> <p>It has been determined that these facilities are not located in a flood plain and they do not encroach on wetlands.</p> <p>D11. ECONOMIC JUSTIFICATION:</p> <p>The proposed project qualifies under ECIP Guidelines in AR-415-15. SIR for the project is 6.5 with a simple payback of 3.08 years. See Economic Analysis, SRP-1.</p>		

1. COMPONENT ARMY	FY 19 <u>94</u> MILITARY CONSTRUCTION PROJECT DATA	2. DATE 06 October 93
3. INSTALLATION AND LOCATION Fort Campbell, Kentucky		
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<p>D12. UTILITY AND COMMUNICATION SUPPORT:</p> <p>A. No related utility support projects are programmed. Adequate utilities are available to support the project.</p> <p>B. No telecommunication support is required.</p> <p>D13. PROTECTION OF HISTORIC PLACES AND ARCHEOLOGICAL SITES:</p> <p>The project involves the replacement of chillers located in basements. Review procedures have been implemented for this project in accordance with 36 CFT 800. The review has established that there will be no effect.</p> <p>D14. PROJECT DEVELOPMENT BROCHURE (PART 1):</p> <p>A Project Development Brochure was prepared on 06 October 93 and is attached as a part of the programming documentation.</p> <p>D15. ENERGY REQUIREMENTS:</p> <p>The proposed project will reduce present energy consumption by 319,804 MBtu/Yr at the cost savings of \$1,279,216 per year. See Energy Requirements Appraisal (ERA) in Special Requirements, Paragraph 3 (SRP-3).</p> <p>D16. PROVISION FOR THE HANDICAPPED:</p> <p>No provisions for the handicapped will be made since the scope of the project is in no way applicable to designing for the handicapped.</p> <p>D17. REAL PROPERTY MAINTENANCE ACTIVITY (RPMA) ANALYSIS:</p> <p>A. Physical impact: There will be twelve (12) chillers removed and replaced by twelve (12) new chillers. No new structures will be added.</p>		

1. COMPONENT ARMY	FY 19 <u>94</u> MILITARY CONSTRUCTION PROJECT DATA	2. DATE 06 October 93										
3. INSTALLATION AND LOCATION Fort Campbell, Kentucky												
4. PROJECT TITLE CHILLER REPLACEMENT	5. PROJECT NUMBER ECIP #1											
<p>B. Operations and Maintenance (O&M) impact:</p> <table style="margin-left: auto; margin-right: auto; border: none;"> <thead> <tr> <th style="text-align: left;"><u>YEAR</u></th> <th style="text-align: center;"><u>O&M</u> <u>NET CHANGE (\$000)</u></th> </tr> </thead> <tbody> <tr> <td>1994</td> <td style="text-align: center;">0.0</td> </tr> <tr> <td>(BOD)</td> <td style="text-align: center;">0.0</td> </tr> <tr> <td>1995</td> <td style="text-align: center;">0.0</td> </tr> <tr> <td>1996</td> <td style="text-align: center;">0.0</td> </tr> </tbody> </table> <p>C. Backlog of Maintenance and Repair (BMAR) impact:</p> <p>There will be no net change in the number of chillers or in chiller life expectancy. There will be no effect on BMAR.</p> <p>D18. COMMERCIAL ACTIVITIES:</p> <p>The proposed project is not a "New Start Expansion" as defined by DA Circular 235-1. The project has been reviewed in light of the requirements of commercial and industrial facilities. It has been determined that whereas the project does not affect commercial facilities, the requirements of DA Circular 235-1 does not apply.</p>			<u>YEAR</u>	<u>O&M</u> <u>NET CHANGE (\$000)</u>	1994	0.0	(BOD)	0.0	1995	0.0	1996	0.0
<u>YEAR</u>	<u>O&M</u> <u>NET CHANGE (\$000)</u>											
1994	0.0											
(BOD)	0.0											
1995	0.0											
1996	0.0											

1. COMPONENT ARMY	FY 19 <u>94</u> MILITARY CONSTRUCTION PROJECT DATA	2. DATE 06 October 93						
3. INSTALLATION AND LOCATION Fort Campbell, Kentucky								
4. PROJECT TITLE CHILLER REPLACEMENTS		5. PROJECT NUMBER ECIP #1						
<p>SPECIAL REQUIREMENTS PARAGRAPH 1 (SRP-1) (continued)</p> <p>D. PROJECT NON ENERGY QUALIFICATION TEST (1) 25% NON ENERGY CALC</p> <table> <tr> <td>4. FIRST YEAR DOLLAR SAVINGS</td> <td>\$1,336,607</td> </tr> <tr> <td>5. TOTAL NET DISCOUNTED SAVINGS</td> <td>\$26,750,220</td> </tr> <tr> <td>6. DISCOUNTED SAVINGS RATIO</td> <td>6.50</td> </tr> </table>			4. FIRST YEAR DOLLAR SAVINGS	\$1,336,607	5. TOTAL NET DISCOUNTED SAVINGS	\$26,750,220	6. DISCOUNTED SAVINGS RATIO	6.50
4. FIRST YEAR DOLLAR SAVINGS	\$1,336,607							
5. TOTAL NET DISCOUNTED SAVINGS	\$26,750,220							
6. DISCOUNTED SAVINGS RATIO	6.50							

1. COMPONENT ARMY	FY 19 <u>94</u> MILITARY CONSTRUCTION PROJECT DATA	2. DATE 06 October 93
3. INSTALLATION AND LOCATION Fort Campbell, Kentucky		
4. PROJECT TITLE CHILLER REPLACEMENTS		5. PROJECT NUMBER ECIP #1
<p>SPECIAL REQUIREMENTS PARAGRAPH 3 (SRP-3)</p> <p>Energy Requirements Appraisal (ERA)</p> <p>1. Project Description: Replace existing single stage absorption chillers with more efficient natural gas engine driven chillers, without reducing the cooling capacities.</p> <p>2. Estimated Energy Consumption: The barracks are currently cooled by single stage absorption chillers. The existing cooling system consumes 366,585 Mbtu/YR of single stage absorption chillers energy. Replacing the existing chillers with natural gas engine driven chillers will result in 301,490 Mbtu/YR of natural gas energy savings, an eighty-six percent (86%) reduction in current energy consumption.</p> <p>3. Energy Sources: No new energy sources are required for the proposed project. The use of solar energy for this project is impractical.</p> <p>4. Energy Use Impacts: The proposed project will substantially reduce the consumption of natural gas for cooling. The burden on the existing base distribution system will be lessened.</p> <p>5. Energy Conservation: The proposed project will reduce annual energy consumption by 301,490 Mbtu/YR with annual energy cost savings of \$1,279,216. The project complies with Army Resources Management Plan (ERMP) and Executive Order 12759.</p> <p>6. Energy Alternatives: The proposed project represents the greatest possible reduction in energy consumption eighty-six percent (86%), without reducing the current cooling levels. The current levels do not exceed the levels recommended by ASHRAE.</p> <p>7. Energy Effects: The proposed project provides positive environmental effects. It reduces the current energy consumption by eighty-six percent (86%), effectively reducing the consumption of non-renewable fuel sources and the resulting polluting air emissions from steam generation. The degrading of environmental standards would not make more efficient energy sources available.</p> <p>8. Basis of Approval: Total energy requirements and alternative fuel sources have been considered and included in this appraisal or discarded as applicable.</p>		

**ENERGY SAVINGS OPPORTUNITY SURVEY
FORT CAMPBELL, KENTUCKY
ECO - 4 PROJECT SUMMARY
ABSORPTION CHILLER REPLACEMENT**

BUILDING NUMBER	BUILDING AREA	CHILLER SIZE (TONS)	BASELINE ENERGY (MBTU)	ECO ENERGY (MBTU)	ENERGY SAVINGS (MBTU)	1ST YEAR SAVINGS	INVESTMENT COSTS	SPB (YR)	SIR
3213	42,627	210	21,527	3,835	17,692	\$78,660	\$202,790	2.58	7.76
3214	42,647	210	21,527	3,835	17,692	78,660	202,790	2.58	7.76
6711	38,329	320	24,212	5,695	18,517	85,654	293,136	3.42	5.78
6718	31,869	140	11,811	2,463	9,348	43,226	151,178	3.50	5.66
6726	38,160	320	24,212	5,695	18,517	85,654	292,863	3.42	5.79
6732	38,442	320	24,212	5,695	18,517	85,654	292,863	3.42	5.79
6910	38,089	305	40,669	5,559	35,110	152,026	292,863	1.93	10.46
6921	1,470	570	58,890	10,463	48,427	212,864	491,489	2.31	8.69
6929	38,281	320	42,637	5,806	36,831	158,910	292,863	1.84	10.94
6936	31,735	180	15,102	3,119	11,983	54,942	180,670	3.29	6.03
6968	38,039	320	42,637	5,806	36,831	158,910	292,863	1.84	10.94
6944	38,063	380	39,149	7,124	32,025	141,449	337,103	2.38	8.41

COOLING TOWERS - TOTAL PROJECT

\$792,051

TOTALS	525,740	3,595	366,585	65,095	301,490	\$1,336,609	\$4,115,522	2.92	6.87
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LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: TOT4-31

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LCCID 1.072

INSTALLATION & LOCATION: FT CAMPBELL REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: TOT-4-3-1 CHILLER - REPLACE ALL WITH NATURAL GAS

FISCAL YEAR 1994 DISCRETE PORTION NAME: CHILLER

ANALYSIS DATE: 10-06-93 ECONOMIC LIFE 20 YEARS PREPARED BY: KEITH DERRING

1. INVESTMENT

A. CONSTRUCTION COST	\$	3724451.		
B. SIOH	\$	186226.		
C. DESIGN COST	\$	204845.		
D. TOTAL COST (1A+1B+1C)	\$	4115522.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)				\$ 4115522.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1992

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 6.18	0.	\$ 0.	14.65	\$ 0.
B. DIST	\$.00	0.	\$ 0.	17.70	\$ 0.
C. RESID	\$.00	0.	\$ 0.	20.99	\$ 0.
D. NAT G	\$ 4.00	301490.	\$ 1205960.	20.60	\$ 24842780.
E. COAL	\$.00	0.	\$ 0.	16.32	\$ 0.
F. PPG	\$.00	0.	\$ 0.	13.59	\$ 0.
M. DEMAND SAVINGS			\$ 0.	13.59	\$ 0.
N. TOTAL		301490.	\$ 1205960.		\$ 24842780.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$	0.
(1) DISCOUNT FACTOR (TABLE A)		13.59	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$	0.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-) (4)
1. REPLACE	\$2612939.	8	.73	1907446.
d. TOTAL	\$2612939.			1907446.

LIFE CYCLE COST ANALYSIS SUMMARY
 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

STUDY: TOT4-31
 LCCID 1.072

INSTALLATION & LOCATION: FT CAMPBELL REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: TOT-4-3-1 CHILLER - REPLACE ALL WITH NATURAL GAS

FISCAL YEAR 1994 DISCRETE PORTION NAME: CHILLER

ANALYSIS DATE: 10-06-93 ECONOMIC LIFE 20 YEARS PREPARED BY: KEITH DERRING

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4)\$ 1907446.

4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3B1d/(YRS \text{ ECONOMIC LIFE}))$ \$ 1336607.

5. SIMPLE PAYBACK PERIOD (1G/4) 3.08 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 26750220.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(5 / 1G)= 6.50
 (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 14.20 %

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS
31 AUGUST 1993

LOCATION: BLDG 3213
TYPE/SIZE: Carrier Single Stage Absorption Chiller/210 Tons
MODEL/SERIAL NUMBER: 16JB021-604/780408152
PUMPS: Two 10 HP Chilled Water, Two 10 HP Condenser Water
PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	2520000	100	0.405	18
95/99	25	2520000	100	0.405	222
90/94	111	2520000	100	0.405	987
85/89	352	2520000	90	0.405	2816
80/84	511	2520000	80	0.405	3634
75/79	664	2520000	67	0.405	3954
70/74	866	2520000	52	0.405	4003
65/69	693	2520000	43	0.405	2649
60/64	471	2520000	35	0.405	1485
55/59	299	2520000	30	0.405	797
50/54	197	2520000	25	0.405	438
45/49	111	2520000	10	0.405	99
40/44	69	2520000	0	0	0

ABSORPTION CHILLER BASELINE ENERGY
CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
TOTAL BASELINE ENERGY

21082
445
21527

ABSORPTION CHILLER BASELINE ENERGY COST
CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
TOTAL BASELINE ENERGY COST

84327
5224
89551

ENERGY CONSUMPTION

21527 MBTU

COST

\$89,551

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 3213
TYPE/SIZE: New Natural Gas Engine Driven Chiller/210 Tons
PUMPS: Two 10 HP Chilled Water, Two 7.5 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	2520000	100	2	3
95/99	25	2520000	100	2	32
90/94	111	2520000	100	2	140
85/89	352	2520000	90	1.92	416
80/84	511	2520000	80	1.85	557
75/79	684	2520000	67	1.75	641
70/74	865	2520000	52	1.67	690
65/69	693	2520000	43	1.65	455
60/64	471	2520000	35	1.56	266
55/59	299	2520000	30	1.5	151
50/54	197	2520000	25	1.45	86
45/49	111	2520000	10	1.36	21
40/44	69	2520000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CHILLED AND CONDENSER WATER PUMP ENERGY

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

3445
389
3834

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST CHILLED AND CONDENSER WATER PUMP ENERGY COST

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

13780
4571
18351

ENERGY CONSUMPTION 3834 MBTU COST \$18,351

NET ENERGY SAVINGS 17692 MBTU NET DOLLAR SAVINGS \$71,200

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 10:50:20

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93

Current UPB/CSI ID: ORL290

H - C A C E S E D I T I O N
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3213-3
3-31

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

TIME 10:50:20

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SYSTEMS SUMMARY.....	7
EQUIPMENT SUMMARY.....	8
LABOR SUMMARY.....	9

DETAILED ESTIMATE

DETAIL PAGE

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* * * END TABLE OF CONTENTS * * *

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 10:50:20

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT \$
16050 BASIC MATERIALS AND METHODS									
16111 5100 INC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION.									
ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN INC CONDUIT W/COUPLING	*** UNIT COSTS: ***			0.14	4.07	0.02	1.70	0.09	5.88
WC=1100	100.00 LF EELEF			14	407	2	170	9	588
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER									
CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	*** UNIT COSTS: ***			19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30 MLF EELEF			6	178	1	248	12	438
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	*** UNIT COSTS: ***			50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00 EA EELEA			50	1,651	0	12,000	600	14,251
TOTAL DIVISION 16 ELECTRICAL				69	2,235	3	12,418	621	15,277
TOTAL FACILITY AA. ELECTRICAL				69	2,235	3	12,418	621	15,277

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3213-3

3-33

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 10:50:20

DETAILED ESTIMATE

DETAIL PAGE 2

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.79
WC=0800	100.00 LF MSPFE			17	459	18	383	19	879
CD=4 HV 2303 4 IN (100MM) P.E. SCH 40	*** UNIT COSTS: ***			0.22	5.92	0.23	5.42	0.27	11.84
WC=0800	100.00 LF MSPFE			22	592	23	542	27	1,184
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2322 4 IN	*** UNIT COSTS: ***			3.50	96.47	3.68	11.11	0.56	111.82
WC=0800	16.00 EA MSPFE			56	1,544	59	178	9	1,789
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2342 4 IN	*** UNIT COSTS: ***			5.26	144.97	5.53	20.60	1.03	172.13
WC=0800	4.00 EA MSPFE			21	580	22	82	4	689
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9101 6" TRIPLE DUTY VALVES	*** UNIT COSTS: ***			3.33	99.77	1.34	1015.00	50.75	1166.86
WC=0900	2.00 EA MSPFA			7	200	3	2,030	102	2,334
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92M) FOR EACH FITTING PLUS 4 LF (1.2M) FOR EACH FLANGED JOINT									
CD=4 HV 1009 4 IN DIA. PIPE, 1 IN THICK	*** UNIT COSTS: ***			0.08	2.51	0.03	1.91	0.10	4.55
WC=0800	100.00 LF AASBC			8	251	3	191	10	455
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3004 210 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			134	3681.00	267.72	102900.00	5145	111993.72
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPFO			134	3,681	268	102,900	5,145	111,994
15670 5000 PUMPS									
CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	3000.00	150.00	3453.33
WC=0900 CASE PUMP	2.00 EA MSPFA			20	599	8	6,000	300	6,907
TOTAL DIVISION 15 MECHANICAL				284	7,905	403	112,306	5,615	126,229
TOTAL FACILITY BA. MECHANICAL				284	7,905	403	112,306	5,615	126,229

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3213-3
3-34

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 10:50:20

TAILED ESTIMATE

DETAIL PAGE 3

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	DOM CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	354		10,140		405	124,724	6,236	141,506
TOTAL BASE BID	354		10,140		405	124,724	6,236	141,506
TOTAL ADDITIVE	0		0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	354		10,140		405	124,724	6,236	141,506

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3213-3
3-35

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

TIME 10:50:20

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

TIME 10:50:20

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 1

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COS
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.27
BA	MECHANICAL	1.00 EA	126,229	10.0% 12,623	0.0% 0	7.5% 10,414	2.5% 3,732	0.0% 0	152,998	152997.51
BID ITEM TOTAL		1.00 EA	141,506	14,151	0	11,674	4,183	0	171,514	171513.78
TOTAL BASE BID			141,506	14,151	0	11,674	4,183	0	171,514	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			141,506	14,151	0	11,674	4,183	0	171,514	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3213-3
 3-37

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

TIME 10:50:20

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
	1. BUILDING TO THE 5 FOOT LINE	1.00	EA	171,514		171,514	171513.70
	TOTAL CURRENT CONTRACT COST			171,514	0	171,514	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			171,514	0	171,514	
	Government-Furnished Property			0		0	
	SUBTOTAL			171,514	0	171,514	
	Contingencies	7.0%		12,006	0	12,006	
	SUBTOTAL			183,520	0	183,520	
	SIOH (S&A)	5.5%		10,094	0	10,094	
	CURRENT WORKING ESTIMATE			193,613	0	193,613	
	Estimated Construction Time	365	Days				

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3213-3
 3-38

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

TIME 10:50:20

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT W/TX	** TOTAL DIRECT **	SUBCON	SUBTOTAL
									AMOUNT PCT	W/OH&P	
AA	GENERAL/PRIME		1.00	EA	354	10,140	405	130,960	141,506 100.0%	0	141,506
	TOTAL DIRECT				354	10,140	405	130,960	141,506 100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3213-3
3-39

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

TIME 10:50:20

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 1

ID	CONTRACTOR	PK	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOFC	**** PROFIT ****	AMOUNT	PCT	BOND	OTHER	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COST
AA	GENERAL/PRINE		141,506	14,151	10.0%	0.0		11,674	7.5%	2.5%	0.0%		171,514	100.0%		171513.74
	TOTAL OVERHEAD & PROFIT			14,151	10.0%			11,674	7.5%							

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

TIME 10:50:20

CSI DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	284	7,905	403	112,306	5,615	126,229
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	354	10,140	405	124,724	6,236	141,506

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3213-3
3-41

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

TIME 10:50:20

SYSTEMS SUMMARY

SUMMARY PAGE

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	123	3,426	124	1,376	69	4,995
09 HEATING, VENTILATION & AIR CONDIT	161	4,479	278	110,930	5,547	121,234
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	354	10,140	405	124,724	6,236	141,506

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3213-3
3-42

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

TIME 10:50:20

EQUIPMENT SUMMARY

SUMMARY PAGE

EQUIP	DESCRIPTION	LIFE HRS	TL	HRLY	OWNRSH	OWNS	OVTH	OWNRSH	EXPENSE	HRLY	UPB	TOTAL	COST
ECR25	CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	6	150	
EMI20	SMALL TOOLS								1.40	1.40	87	120	
EWE10	WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	78	120	
TOTAL PROJECT EQUIPMENT HOURS												171	400

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3213 OPTION 3

TIME 10:50:20

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT	DESCRIPTION	BASE	OVERTH	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	**** TOTAL COST
LASBW	ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	8	251
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	32	783
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	6	210
LSPFI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	238	6,662
TOTAL PROJECT MANHOURS									354	10,140

* * * END OF SUMMARY REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3213-3
3-44

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS
31 AUGUST 1993

LOCATION: BLDG 3214
TYPE/SIZE: York Single Stage Absorption Chiller/210 Tons
MODEL/SERIAL NUMBER: ESA244A/EM095547
PUMPS: Two 10 HP Chilled Water, Two 10 HP Condenser Water
PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	2520000	100	0.405	18
95/99	25	2520000	100	0.405	222
90/94	111	2520000	100	0.405	987
85/89	352	2520000	90	0.405	2816
80/84	511	2520000	80	0.405	3634
75/79	664	2520000	67	0.405	3954
70/74	866	2520000	52	0.405	4003
65/69	693	2520000	43	0.405	2649
60/64	471	2520000	35	0.405	1485
55/59	299	2520000	30	0.405	797
50/54	197	2520000	25	0.405	438
45/49	111	2520000	10	0.405	99
40/44	69	2520000	0	0	0

ABSORPTION CHILLER BASELINE ENERGY
CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
TOTAL BASELINE ENERGY

21082
445
21527

ABSORPTION CHILLER BASELINE ENERGY COST
CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
TOTAL BASELINE ENERGY COST

84327
5224
89551

ENERGY CONSUMPTION

21527 MBTU

COST

\$89,551

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 3214
TYPE/SIZE: New Natural Gas Engine Driven Chiller/210 Tons
PUMPS: Two 10 HP Chilled Water, Two 7.5 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	2520000	100	2	3
95/99	25	2520000	100	2	32
90/94	111	2520000	100	2	140
85/89	352	2520000	90	1.92	416
80/84	511	2520000	80	1.85	557
75/79	684	2520000	67	1.75	841
70/74	865	2520000	52	1.67	680
65/69	693	2520000	43	1.65	455
60/64	471	2520000	35	1.58	286
55/59	299	2520000	30	1.5	151
50/54	197	2520000	25	1.45	86
45/49	111	2520000	10	1.38	21
40/44	69	2520000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CHILLED AND CONDENSER WATER PUMP ENERGY

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

3445
389
3834

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST CHILLED AND CONDENSER WATER PUMP ENERGY COST

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

13780
4571
18351

ENERGY CONSUMPTION 3834 MBTU COST \$18,351

NET ENERGY SAVINGS 17692 MBTU NET DOLLAR SAVINGS \$71,200

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 11:35:5

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93

Current UPB/CSI ID: ORL290

M - C A C E S E D I T I O N
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3214-3
3-47

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

TIME 11:35:54

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1. BUILDING TO THE 5 FOOT LINE	
AA. ELECTRICAL.....	1
BA. MECHANICAL.....	2

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Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 11:35:5

DETAILED ESTIMATE

DETAIL PAGE

BASE BI

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT
16050 BASIC MATERIALS AND METHODS									
16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION. ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	*** UNIT COSTS: ***			0.14	4.07	0.02	1.70	0.09	5.8.
WC=1100	100.00 LF EELEF		14	407	2	170	9	58.	
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	*** UNIT COSTS: ***			19.62	591.69	2.65	825.93	41.30	1461.5
WC=1100	0.30 MLF EELEF		6	178	1	248	12	438	
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	*** UNIT COSTS: ***			50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00 EA EELEA		50	1,651	0	12,000	600	14,251	
TOTAL DIVISION 16 ELECTRICAL				69	2,235	3	12,418	621	15,271
TOTAL FACILITY AA. ELECTRICAL				69	2,235	3	12,418	621	15,271

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3214-3
 3-49

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 11:35:54

DETAILED ESTIMATE

DETAIL PAGE 2

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.79
WC=0800	100.00 LF MSPFE			17	459	18	383	19	879
CD=4 HV 2303 4 IN (100MM) P.E. SCH 40	*** UNIT COSTS: ***			0.22	5.92	0.23	5.42	0.27	11.84
WC=0800	100.00 LF MSPFE			22	592	23	542	27	1,184
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2322 4 IN	*** UNIT COSTS: ***			3.50	96.47	3.68	11.11	0.56	111.82
WC=0800	16.00 EA MSPFE			56	1,544	59	178	9	1,789
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2342 4 IN	*** UNIT COSTS: ***			5.26	144.97	5.53	20.60	1.03	172.13
WC=0800	4.00 EA MSPFE			21	580	22	82	4	689
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9101 6" TRIPLE DUTY VALVES	*** UNIT COSTS: ***			3.33	99.77	1.34	1015.00	50.75	1166.86
WC=0900	2.00 EA MSPFA			7	200	3	2,030	102	2,334
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92H) FOR EACH FITTING PLUS 4 LF (1.2H) FOR EACH FLANGED JOINT									
CD=4 HV 1009 4 IN DIA. PIPE, 1 IN THICK	*** UNIT COSTS: ***			0.08	2.51	0.03	1.91	0.10	4.55
WC=0800	100.00 LF AASBC			8	251	3	191	10	455
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3004 210 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			134	3681.00	267.72	102900.00	5145	111993.72
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPFO			134	3,681	268	102,900	5,145	111,994
15670 5000 PUMPS									
CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	3000.00	150.00	3453.33
WC=0900 CASE PUMP	2.00 EA MSPFA			20	599	8	6,000	300	6,907
TOTAL DIVISION 15 MECHANICAL				284	7,905	403	112,306	5,615	126,229
TOTAL FACILITY BA. MECHANICAL				284	7,905	403	112,306	5,615	126,229

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3214-3
3-50

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 11:35:54

TAILED ESTIMATE

DETAIL PAGE 3

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	DOM CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	354		10,140		405	124,724	6,236	141,506
TOTAL BASE BID	354		10,140		405	124,724	6,236	141,506
TOTAL ADDITIVE	0		0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	354		10,140		405	124,724	6,236	141,506

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3214-3
3-51

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

TIME 11:35:54

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

TIME 11:35:54

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.22
BA	MECHANICAL	1.00 EA	126,229	10.0% 12,623	0.0% 0	7.5% 10,414	2.5% 3,732	0.0% 0	152,998	152997.52
BID ITEM TOTAL		1.00 EA	141,506	14,151	0	11,674	4,183	0	171,514	171513.74
TOTAL BASE BID			141,506	14,151	0	11,674	4,183	0	171,514	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			141,506	14,151	0	11,674	4,183	0	171,514	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3214-3
3-53

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

TIME 11:35:5

PROJECT CWE SUMMARY

SUMMARY PAGE

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
1.	BUILDING TO THE 5 FOOT LINE	1.00	EA	171,514		171,514	171513.70
	TOTAL CURRENT CONTRACT COST			171,514	0	171,514	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			171,514	0	171,514	
	Government-Furnished Property			0		0	
	SUBTOTAL			171,514	0	171,514	
	Contingencies	7.0%		12,006	0	12,006	
	SUBTOTAL			183,520	0	183,520	
	SIOH (S&A)	5.5%		10,094	0	10,094	
	CURRENT WORKING ESTIMATE			193,613	0	193,613	

Estimated Construction Time 365 Days

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3214-3
 3-54

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

TIME 11:35:54

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT *	* SUBCON *	W/OH&P	SUBTOTAL
						AMOUNT	PCT						
AA	GENERAL/PRIME		1.00	EA	354	10,140	405	130,960		141,506	100.0%	0	141,506
	TOTAL DIRECT				354	10,140	405	130,960		141,506	100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3214-3
3-55

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

TIME 11:35:54

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PH	SUBTOTAL	*** OVERHEAD *** AMOUNT	PCT	HOFC%	**** PROFIT **** AMOUNT	PCT	BOND%	OTHER%	***** TOTAL CONTRACT ***** AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		141,506	14,151	10.0%	0.0	11,674	7.5%	2.5%	0.0%	171,514	100.0%	171513.74
	TOTAL OVERHEAD & PROFIT			14,151	10.0%		11,674	7.5%					

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

TIME 11:35:54

CSI DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	284	7,905	403	112,306	5,615	126,229
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	354	10,140	405	124,724	6,236	141,506

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

TIME 11:35:5

SYSTEMS SUMMARY

SUMMARY PAGE

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	123	3,426	124	1,376	69	4,995
09 HEATING, VENTILATION & AIR CONDIT	161	4,479	278	110,930	5,547	121,234
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	354	10,140	405	124,724	6,236	141,506

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3214-3
3-58

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

TIME 11:35:5

EQUIPMENT SUMMARY

SUMMARY PAGE

EQUIP	DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
ECR25	CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	6	158
EMI20	SMALL TOOLS								1.40	1.40	87	122
EWEL0	WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	78	127
TOTAL PROJECT EQUIPMENT HOURS											171	408

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 3214 OPTION 3

TIME 11:35:5

LABOR SUMMARY

SUMMARY PAGE

CRAFT	DESCRIPTION	BASE	OVERTH	T&S/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LASBW	ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	8	251
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	32	783
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	6	210
LSPFI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	238	6,662
TOTAL PROJECT MANHOURS									354	10,140

* * * END OF SUMMARY REPORT * * *

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6711
 TYPE/SIZE: Carrier Single Stage Absorption Chiller/320 Tons
 MODEL/SERIAL NUMBER: 16JB036--604/744307616
 PUMPS: Two 10 HP Chilled Water, Two 15 HP Condenser Water
 PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3840000	100	0.55	20
95/99	25	3840000	100	0.55	249
90/94	111	3840000	100	0.55	1107
85/89	352	3840000	90	0.55	3160
80/84	511	3840000	80	0.55	4077
75/79	664	3840000	67	0.55	4437
70/74	866	3840000	52	0.55	4492
65/69	693	3840000	43	0.55	2972
60/64	471	3840000	35	0.55	1644
55/59	299	3840000	30	0.55	895
50/54	197	3840000	25	0.55	491
45/49	111	3840000	10	0.55	111
40/44	69	3840000	0	0	0

ABSORPTION CHILLER BASELINE ENERGY
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
 TOTAL BASELINE ENERGY

23655
 558
 24212

ABSORPTION CHILLER BASELINE ENERGY COST
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
 TOTAL BASELINE ENERGY COST

94621
 6530
 101151

ENERGY CONSUMPTION

24212 MBTU

COST

\$101,151

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4; REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6711
TYPE/SIZE: New Natural Gas Engine Driven Chiller/320 Tons
PUMPS: Two 10 HP Chilled Water, Two 10 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3840000	100	2	4
95/99	25	3840000	100	2	48
90/94	111	3840000	100	2	213
85/89	352	3840000	90	1.92	634
80/84	511	3840000	80	1.85	849
75/79	664	3840000	67	1.75	978
70/74	866	3840000	52	1.67	1035
65/69	693	3840000	43	1.65	694
60/64	471	3840000	35	1.56	406
55/59	299	3840000	30	1.5	230
50/54	197	3840000	25	1.45	130
45/49	111	3840000	10	1.38	31
40/44	69	3840000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY
CHILLED AND CONDENSER WATER PUMP ENERGY

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

5249
445
5694

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST
CHILLED AND CONDENSER WATER PUMP ENERGY COST

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

20988
5224
26222

ENERGY CONSUMPTION

5694 MBTU

COST

\$26,222

NET ENERGY SAVINGS

18517 MBTU

NET DOLLAR SAVINGS

\$74,929

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 09:45:16

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93
Current UPB/CSI ID: ORL290

M - C A C E S E D I T I O N
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6711-3
3-63

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

TIME 09:45:16

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* * * END TABLE OF CONTENTS * * *

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 09:45:16

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16050 BASIC MATERIALS AND METHODS									
16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION. ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	*** UNIT COSTS: ***			0.14	4.07	0.02	1.70	0.09	5.88
WC=1100	100.00 LF EELEF			14	407	2	170	9	588
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	*** UNIT COSTS: ***			19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30 MLF EELEF			6	178	1	248	12	438
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	*** UNIT COSTS: ***			50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00 EA EELEA			50	1,651	0	12,000	600	14,251
TOTAL DIVISION 16 ELECTRICAL				69	2,235	3	12,418	621	15,277
TOTAL FACILITY AA. ELECTRICAL				69	2,235	3	12,418	621	15,277

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6711-3
3-65

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 09:45:1

DETAILED ESTIMATE

DETAIL PAGE

BASE BI

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.7
WC=0800	100.00 LF MSPFE			17	459	18	383	19	87
CD=4 HV 2305 6 IN (150MM) P.E. SCH 40	*** UNIT COSTS: ***			0.32	8.89	0.34	8.44	0.42	18.0
WC=0800	100.00 LF MSPFE			32	889	34	844	42	1,80
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2323 6 IN	*** UNIT COSTS: ***			5.78	159.21	6.08	27.20	1.36	193.8
WC=0800	16.00 EA MSPFE			92	2,547	97	435	22	3,10
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2343 6 IN	*** UNIT COSTS: ***			8.70	239.51	9.14	37.50	1.88	288.0
WC=0800	4.00 EA MSPFE			35	958	37	150	8	1,15
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9101 6" TRIPLE DUTY VALVES	*** UNIT COSTS: ***			3.33	99.77	1.34	1015.00	50.75	1166.8
WC=0900	2.00 EA MSPFA			7	200	3	2,030	102	2,33
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92M) FOR EACH FITTING PLUS 4 LF (1.2M) FOR EACH FLANGED JOINT									
CD=4 HV 1011 6 IN DIA. PIPE, 1-1/2 IN THK	*** UNIT COSTS: ***			0.11	3.30	0.04	3.17	0.16	6.6
WC=0800	100.00 LF AASBC			11	330	4	317	16	66
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3001 320 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			258	7078.85	514.85	156800.00	7840	172233.65
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPFO			258	7,079	515	156,800	7,840	172,234
15670 5000 PUMPS									
CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	3000.00	150.00	3453.33
WC=0900 CASE PUMP	2.00 EA MSPFA			20	599	8	6,000	300	6,90
TOTAL DIVISION 15 MECHANICAL				472	13,060	715	166,959	8,348	189,082
TOTAL FACILITY BA. MECHANICAL				472	13,060	715	166,959	8,348	189,082

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6711-3
3-66

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 09:45:10

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	541			15,295		717	179,377	8,969	204,359
TOTAL BASE BID	541			15,295		717	179,377	8,969	204,359
TOTAL ADDITIVE	0			0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	541			15,295		717	179,377	8,969	204,359

* * * END OF DETAIL REPORT * * *

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

TIME 09:45:16

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

TIME 09:45:10

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 1

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.21
BA	MECHANICAL	1.00 EA	189,082	10.0% 18,908	0.0% 0	7.5% 15,599	2.5% 5,590	0.0% 0	229,179	229179.31
BID ITEM TOTAL		1.00 EA	204,359	20,436	0	16,860	6,041	0	247,696	247695.53
TOTAL BASE BID			204,359	20,436	0	16,860	6,041	0	247,696	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			204,359	20,436	0	16,860	6,041	0	247,696	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6711-3
 3-69

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

TIME 09:45:16

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
	1. BUILDING TO THE 5 FOOT LINE	1.00	EA	247,696		247,696	247695.50
	TOTAL CURRENT CONTRACT COST			247,696	0	247,696	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			247,696	0	247,696	
	Government-Furnished Property			0		0	
	SUBTOTAL			247,696	0	247,696	
	Contingencies	7.0%		17,339	0	17,339	
	SUBTOTAL			265,034	0	265,034	
	SIOH (S&A)	5.5%		14,577	0	14,577	
	CURRENT WORKING ESTIMATE			279,611	0	279,611	

Estimated Construction Time 365 Days

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6711-3
 3-70

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

TIME 09:45:16

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT *	* SUBCON *	W/OH&P	SUBTOTAL
										AMOUNT	PCT		
AA	GENERAL/PRIME		1.00	EA	541	15,295	717	188,346		204,359	100.0%	0	204,359
	TOTAL DIRECT				541	15,295	717	188,346		204,359	100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6711-3
3-71

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

TIME 09:45:1

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE

ID	CONTRACTOR	PM	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOFC%	**** PROFIT ****	AMOUNT	PCT	BOND%	OTHER%	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COS
AA	GENERAL/PRIME		204,359	20,436	10.0%	0.0		16,860	7.5%	2.5%	0.0%		247,696	100.0%		247695.5
	TOTAL OVERHEAD & PROFIT			20,436	10.0%			16,860	7.5%							

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6711-3
3-72

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

TIME 09:45:10

CSI DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	472	13,060	715	166,959	8,348	189,082
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

TIME 09:45:16

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	187	5,183	189	2,129	106	7,608
09 HEATING, VENTILATION & AIR CONDIT	285	7,877	526	164,830	8,242	181,474
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

TIME 09:45:10

EQUIPMENT SUMMARY

SUMMARY PAGE 3

EQUIP	DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
ECR25	CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	12	301
EMI20	SMALL TOOLS								1.40	1.40	143	200
EWEL0	WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	132	214
											288	711
TOTAL PROJECT EQUIPMENT HOURS												

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6711 OPTION 3

TIME 09:45:16

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT	DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LASBW	ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	11	330
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	62	1,505
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	12	403
LSPFI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	387	10,821
TOTAL PROJECT MANHOURS									541	15,295

*** END OF SUMMARY REPORT ***

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6711-3
3-76

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS
31 AUGUST 1993

LOCATION: BLDG 6718
TYPE/SIZE: Carrier Single Stage Absorption Chiller/140 Tons
MODEL/SERIAL NUMBER: 16JB014-604744307614
PUMPS: One 7.5 HP Chilled Water, One 10 HP Condenser Water
PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	1680000	100	0.49	10
95/99	25	1680000	100	0.49	122
90/94	111	1680000	100	0.49	544
85/89	352	1680000	90	0.49	1552
80/84	511	1680000	80	0.49	2002
75/79	664	1680000	67	0.49	2179
70/74	866	1680000	52	0.49	2206
65/69	693	1680000	43	0.49	1460
60/64	471	1680000	35	0.49	807
55/59	299	1680000	30	0.49	439
50/54	197	1680000	25	0.49	241
45/49	111	1680000	10	0.49	54
40/44	69	1680000	0	0	0

ABSORPTION CHILLER BASELINE ENERGY
CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
TOTAL BASELINE ENERGY

11616
195
11811

ABSORPTION CHILLER BASELINE ENERGY COST
CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
TOTAL BASELINE ENERGY COST

46486
2286
48751

ENERGY CONSUMPTION

11811 MBTU

COST

\$48,751

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6718
TYPE/SIZE: New Natural Gas Engine Driven Chiller/140 Tons
PUMPS: One 7.5 HP Chilled Water, One 7.5 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	1680000	100	2	2
95/99	25	1680000	100	2	21
90/94	111	1680000	100	2	93
85/89	352	1680000	90	1.92	277
80/84	511	1680000	80	1.85	371
75/79	664	1680000	67	1.75	427
70/74	866	1680000	52	1.67	453
65/69	693	1680000	43	1.65	303
60/64	471	1680000	35	1.56	178
55/59	299	1680000	30	1.5	100
50/54	197	1680000	25	1.45	57
45/49	111	1680000	10	1.36	14
40/44	69	1680000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CHILLED AND CONDENSER WATER PUMP ENERGY

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

2297
167
2463

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST CHILLED AND CONDENSER WATER PUMP ENERGY COST

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

9187
1959
11146

ENERGY CONSUMPTION 2463 MBTU COST \$11,146

NET ENERGY SAVINGS 9348 MBTU NET DOLLAR SAVINGS \$37,606

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 11:58:18

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93
Current UPB/CSI ID: ORL290

M - C A C E S E D I T I O N
COMPOSER Plus Copyright (C) 1985, 1988
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6718-3
3-79

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

TIME 11:58:1

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Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 11:58:18

TAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16050 BASIC MATERIALS AND METHODS									
16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION.									
ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	*** UNIT COSTS: ***			0.14	4.07	0.02	1.70	0.09	5.88
WC=1100	100.00 LF EELEF			14	407	2	170	9	588
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER									
CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	*** UNIT COSTS: ***			19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30 MLF EELEF			6	178	1	248	12	438
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	*** UNIT COSTS: ***			50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00 EA EELEA			50	1,651	0	12,000	600	14,251
TOTAL DIVISION 16 ELECTRICAL				69	2,235	3	12,418	621	15,277
TOTAL FACILITY AA. ELECTRICAL				69	2,235	3	12,418	621	15,277

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6718-3
 3-81

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 11:58:18

TAILED ESTIMATE

DETAIL PAGE 2

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.79
WC=0800	100.00 LF MSPFE			17	459	18	383	19	879
CD=4 HV 2303 4 IN (100MM) P.E. SCH 40	*** UNIT COSTS: ***			0.22	5.92	0.23	5.42	0.27	11.84
WC=0800	100.00 LF MSPFE			22	592	23	542	27	1,184
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2322 4 IN	*** UNIT COSTS: ***			3.50	96.47	3.68	11.11	0.56	111.82
WC=0800	16.00 EA MSPFE			56	1,544	59	178	9	1,789
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2342 4 IN	*** UNIT COSTS: ***			5.26	144.97	5.53	20.60	1.03	172.13
WC=0800	4.00 EA MSPFE			21	580	22	82	4	689
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9101 6" TRIPLE DUTY VALVES	*** UNIT COSTS: ***			3.33	99.77	1.34	1015.00	50.75	1166.86
WC=0900	2.00 EA MSPFA			7	200	3	2,030	102	2,334
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92M) FOR EACH FITTING PLUS 4 LF (1.2M) FOR EACH FLANGED JOINT									
CD=4 HV 1009 4 IN DIA. PIPE, 1 IN THICK	*** UNIT COSTS: ***			0.08	2.51	0.03	1.91	0.10	4.55
WC=0800	100.00 LF AASBC			8	251	3	191	10	455
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3002 140 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			134	3681.00	267.72	68600.00	3430	75978.72
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPFO			134	3,681	268	68,600	3,430	75,979
15670 5000 PUMPS									
CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	3000.00	150.00	3453.33
WC=0900 CASE PUMP	2.00 EA MSPFA			20	599	8	6,000	300	6,907
TOTAL DIVISION 15 MECHANICAL				284	7,905	403	78,006	3,900	90,214
TOTAL FACILITY BA. MECHANICAL				284	7,905	403	78,006	3,900	90,214

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6718-3
3-82

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 11:58:18

DETAILED ESTIMATE

DETAIL PAGE 3

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	DOM CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	354		10,140		405	90,424	4,521	105,491
TOTAL BASE BID	354		10,140		405	90,424	4,521	105,491
TOTAL ADDITIVE	0		0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	354		10,140		405	90,424	4,521	105,491

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6718-3
3-83

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

TIME 11:58:18

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6718-3
3-84

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

TIME 11:58:1

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 1

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.21
BA	MECHANICAL	1.00 EA	90,214	10.0% 9,021	0.0% 0	7.5% 7,443	2.5% 2,667	0.0% 0	109,345	109345.09
BID ITEM TOTAL		1.00 EA	105,491	10,549	0	8,703	3,119	0	127,861	127861.30
TOTAL BASE BID			105,491	10,549	0	8,703	3,119	0	127,861	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			105,491	10,549	0	8,703	3,119	0	127,861	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6718-3
 3-85

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

TIME 11:58:18

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
	1. BUILDING TO THE 5 FOOT LINE	1.00	EA	127,861		127,861	127861.30
	TOTAL CURRENT CONTRACT COST			127,861	0	127,861	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			127,861	0	127,861	
	Government-Furnished Property			0		0	
	SUBTOTAL			127,861	0	127,861	
	Contingencies	7.0%		8,950	0	8,950	
	SUBTOTAL			136,812	0	136,812	
	SIOH (S&A)	5.5%		7,525	0	7,525	
	CURRENT WORKING ESTIMATE			144,336	0	144,336	
	Estimated Construction Time	365	Days				

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

TIME 11:58:18

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT * AMOUNT PCT	* SUBCON * W/OH&P	SUBTOTAL
AA	GENERAL/PRIME		1.00	EA	354	10,140	405	94,945		105,491 100.0%	0	105,491
	TOTAL DIRECT				354	10,140	405	94,945		105,491 100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6718-3
3-87

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

TIME 11:58:18

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PM	SUBTOTAL	*** OVERHEAD *** AMOUNT	PCT	HOFC%	**** PROFIT **** AMOUNT	PCT	BOND%	OTHER%	***** TOTAL CONTRACT ***** AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		105,491	10,549	10.0%	0.0	8,703	7.5%	2.5%	0.0%	127,861	100.0%	127861.31
	TOTAL OVERHEAD & PROFIT			10,549	10.0%		8,703	7.5%					

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6718-3
3-88

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

TIME 11:58:1.

SI DIVISION SUMMARY

SUMMARY PAGE

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	284	7,905	403	78,006	3,900	90,214
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	354	10,140	405	90,424	4,521	105,491

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6718-3
3-89

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

TIME 11:58:1

SYSTEMS SUMMARY

SUMMARY PAGE

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	123	3,426	124	1,376	69	4,995
09 HEATING, VENTILATION & AIR CONDIT	161	4,479	278	76,630	3,832	85,219
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	354	10,140	405	90,424	4,521	105,491

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

TIME 11:58:18

SUMMARY PAGE 8

EQUIPMENT SUMMARY

EQUIP	DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
ECR25	CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	6	158
EMI20	SMALL TOOLS								1.40	1.40	87	121
EWEL0	WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	78	127
											171	405
TOTAL PROJECT EQUIPMENT HOURS												

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6718 OPTION 3

TIME 11:58:18

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT	DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LASBW	ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	8	251
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	32	783
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	6	210
LSPFI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	238	6,662
TOTAL PROJECT MANHOURS									354	10,140

* * * END OF SUMMARY REPORT * * *

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6726
 TYPE/SIZE: Carrier Single Stage Absorption Chiller/320 Tons
 MODEL/SERIAL NUMBER: 16.B036-604/744307615
 PUMPS: Two 10 HP Chilled Water, Two 15 HP Condenser Water
 PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3840000	100	0.55	20
95/99	25	3840000	100	0.55	249
90/94	111	3840000	100	0.55	1107
85/89	352	3840000	90	0.55	3160
80/84	511	3840000	80	0.55	4077
75/79	664	3840000	67	0.55	4437
70/74	868	3840000	52	0.55	4492
65/69	693	3840000	43	0.55	2972
60/64	471	3840000	35	0.55	1644
55/59	299	3840000	30	0.55	895
50/54	197	3840000	25	0.55	491
45/49	111	3840000	10	0.55	111
40/44	69	3840000	0	0	0

ABSORPTION CHILLER BASELINE ENERGY
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
 TOTAL BASELINE ENERGY

23655
 556
 24212

ABSORPTION CHILLER BASELINE ENERGY COST
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
 TOTAL BASELINE ENERGY COST

94621
 6530
 101151

ENERGY CONSUMPTION

24212 MBTU

COST

\$101,151

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6726
TYPE/SIZE: New Natural Gas Engine Driven Chiller/320 Tons
PUMPS: Two 10 HP Chilled Water, Two 10 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3840000	100	2	4
95/99	25	3840000	100	2	48
90/94	111	3840000	100	2	218
85/89	352	3840000	90	1.92	634
80/84	511	3840000	80	1.85	849
75/79	664	3840000	67	1.75	976
70/74	866	3840000	52	1.67	1035
65/69	593	3840000	43	1.65	894
60/64	471	3840000	35	1.58	406
55/59	289	3840000	30	1.5	230
50/54	197	3840000	25	1.45	130
45/49	111	3840000	10	1.38	31
40/44	69	3840000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY
CHILLED AND CONDENSER WATER PUMP ENERGY

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

5249
445
5694

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST
CHILLED AND CONDENSER WATER PUMP ENERGY COST
TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

20998
5224
26222

ENERGY CONSUMPTION 5694 MBTU COST \$26,222

NET ENERGY SAVINGS 18517 MBTU NET DOLLAR SAVINGS \$74,929

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 09:59:35

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93

Current UPB/CSI ID: ORL290

M - C A C E S E D I T I O N
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6726-3
3-95

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

TIME 09:59:35

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DETAILED ESTIMATE

DETAIL PAGE

1. BUILDING TO THE 5 FOOT LINE	
AA. ELECTRICAL.....	1
BA. MECHANICAL.....	2

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Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 09:59:31

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BII

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16050 BASIC MATERIALS AND METHODS									
16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION.									
ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	*** UNIT COSTS: ***			0.14	4.07	0.02	1.70	0.09	5.88
WC=1100	100.00 LF EELEF		14	407	2	170	9	588	
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER									
CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	*** UNIT COSTS: ***			19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30 MLF EELEF		6	178	1	248	12	438	
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	*** UNIT COSTS: ***			50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00 EA EELEA		50	1,651	0	12,000	600	14,251	
TOTAL DIVISION 16 ELECTRICAL				69	2,235	3	12,418	621	15,277
TOTAL FACILITY AA. ELECTRICAL				69	2,235	3	12,418	621	15,277

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6726-3
 3-97

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 09:59:35

TAILED ESTIMATE

DETAIL PAGE 2

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	DOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.79
WC=0800	100.00 LF MSPFE			17	459	18	383	19	879
CD=4 HV 2305 6 IN (150MM) P.E. SCH 40	*** UNIT COSTS: ***			0.32	8.89	0.34	8.44	0.42	18.09
WC=0800	100.00 LF MSPFE			32	889	34	844	42	1,809
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2323 6 IN	*** UNIT COSTS: ***			5.78	159.21	6.08	27.20	1.36	193.85
WC=0800	16.00 EA MSPFE			92	2,547	97	435	22	3,102
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2343 6 IN	*** UNIT COSTS: ***			8.70	239.51	9.14	37.50	1.88	288.02
WC=0800	4.00 EA MSPFE			35	958	37	150	8	1,152
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9101 6" TRIPLE DUTY VALVES	*** UNIT COSTS: ***			3.33	99.77	1.34	1015.00	50.75	1166.86
WC=0900	2.00 EA MSPFA			7	200	3	2,030	102	2,334
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92M) FOR EACH FITTING PLUS 4 LF (1.2M) FOR EACH FLANGED JOINT									
CD=4 HV 1011 6 IN DIA. PIPE, 1-1/2 IN THK	*** UNIT COSTS: ***			0.11	3.30	0.04	3.17	0.16	6.67
WC=0800	100.00 LF AASBC			11	330	4	317	16	667
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3001 320 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			258	7078.85	514.85	156800.00	7840	172233.69
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPFO			258	7,079	515	156,800	7,840	172,234
15670 5000 PUMPS									
CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	3000.00	150.00	3453.33
WC=0900 CASE PUMP	2.00 EA MSPFA			20	599	8	6,000	300	6,907
TOTAL DIVISION 15 MECHANICAL				472	13,060	715	166,959	8,348	189,082
TOTAL FACILITY BA. MECHANICAL				472	13,060	715	166,959	8,348	189,082

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6726-3
3-98

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 09:59:35

DETAILED ESTIMATE

DETAIL PAGE 3

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	541			15,295		717	179,377	8,969	204,359
TOTAL BASE BID	541			15,295		717	179,377	8,969	204,359
TOTAL ADDITIVE	0			0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	541			15,295		717	179,377	8,969	204,359

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6726-3
3-99

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

TIME 09:59:35

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

TIME 09:59:35

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OPC	PROFIT	BOND	OTHER PCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.22
BA	MECHANICAL	1.00 EA	189,082	10.0% 18,908	0.0% 0	7.5% 15,599	2.5% 5,590	0.0% 0	229,179	229179.31
BID ITEM TOTAL		1.00 EA	204,359	20,436	0	16,860	6,041	0	247,696	247695.53
TOTAL BASE BID			204,359	20,436	0	16,860	6,041	0	247,696	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			204,359	20,436	0	16,860	6,041	0	247,696	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6726-3
 3-101

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

TIME 09:59:30

PROJECT CWE SUMMARY

SUMMARY PAGE

ID	BID ITEM	QUANTITY UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
	1. BUILDING TO THE 5 FOOT LINE	1.00 EA	247,696		247,696	247695.50
	TOTAL CURRENT CONTRACT COST		247,696	0	247,696	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%	0	0	0	
	ESCALATED CONTRACT COST		247,696	0	247,696	
	Government-Furnished Property		0		0	
	SUBTOTAL		247,696	0	247,696	
	Contingencies	7.0%	17,339	0	17,339	
	SUBTOTAL		265,034	0	265,034	
	SIOH (S&A)	5.5%	14,577	0	14,577	
	CURRENT WORKING ESTIMATE		279,611	0	279,611	
	Estimated Construction Time	365 Days				

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6726-3
3-102

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

TIME 09:59:35

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	DOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT **	** SUBCON **	W/OH&P	SUBTOTAL
										AMOUNT	PCT		
AA	GENERAL/PRIME		1.00	EA	541	15,295	717	188,346		204,359	100.0%	0	204,359
	TOTAL DIRECT				541	15,295	717	188,346		204,359	100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6726-3
3-103

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

TIME 09:59:35

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PH	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOPC%	**** PROFIT ****	AMOUNT	PCT	BOND%	OTHER%	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		204,359	20,436	10.0%	0.0		16,860	7.5%	2.5%	0.0%		247,696	100.0%		247695.54
	TOTAL OVERHEAD & PROFIT			20,436	10.0%			16,860	7.5%							

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6726-3
3-104

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

TIME 09:59:3

CSI DIVISION SUMMARY

SUMMARY PAGE

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	472	13,060	715	166,959	8,348	189,082
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6726-3
3-105

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

TIME 09:59:3

SYSTEMS SUMMARY

SUMMARY PAGE

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	187	5,183	189	2,129	106	7,608
09 HEATING, VENTILATION & AIR CONDIT	285	7,877	526	164,830	8,242	181,474
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6726-3
3-106

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

TIME 09:59:35

EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
ECR25 CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	12	303
EMI20 SMALL TOOLS								1.40	1.40	143	200
EWEL0 WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	132	214
TOTAL PROJECT EQUIPMENT HOURS										288	717

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6726 OPTION 3

TIME 09:59:35

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT DESCRIPTION	BASE	OVERTH	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	**** TOTAL COST
LASBW ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	11	330
LELEC ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	62	1,505
LOEME EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	12	403
LSPFI STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	387	10,821
TOTAL PROJECT MANHOURS								541	15,295

*** END OF SUMMARY REPORT ***

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS
31 AUGUST 1993

LOCATION: BLDG 6732
TYPE/SIZE: Carrier Single Stage Absorption Chiller/320 Tons
MODEL/SERIAL NUMBER: 16JB036-604/744307585
PUMPS: Two 10 HP Chilled Water, Two 15 HP Condenser Water
PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3840000	100	0.55	20
95/99	25	3840000	100	0.55	249
90/94	111	3840000	100	0.55	1107
85/89	352	3840000	90	0.55	3160
80/84	511	3840000	80	0.55	4077
75/79	664	3840000	67	0.55	4437
70/74	866	3840000	52	0.55	4492
65/69	693	3840000	43	0.55	2972
60/64	471	3840000	35	0.55	1644
55/59	299	3840000	30	0.55	895
50/54	197	3840000	25	0.55	491
45/49	111	3840000	10	0.55	111
40/44	69	3840000	0	0	0

ABSORPTION CHILLER BASELINE ENERGY
CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
TOTAL BASELINE ENERGY

23655
558
24212

ABSORPTION CHILLER BASELINE ENERGY COST
CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
TOTAL BASELINE ENERGY COST

94621
6530
101151

ENERGY CONSUMPTION

24212 MBTU

COST

\$101,151

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6732
TYPE/SIZE: New Natural Gas Engine Driven Chiller/320 Tons
PUMPS: Two 10 HP Chilled Water, Two 10 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3840000	100	2	4
95/99	25	3840000	100	2	48
90/94	111	3840000	100	2	213
85/89	352	3840000	90	1.92	634
80/84	511	3840000	80	1.85	849
75/79	664	3840000	67	1.75	876
70/74	866	3840000	52	1.67	1035
65/69	693	3840000	43	1.55	694
60/64	471	3840000	35	1.56	406
55/59	299	3840000	30	1.5	230
50/54	197	3840000	25	1.45	130
45/49	111	3840000	10	1.36	31
40/44	69	3840000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CHILLED AND CONDENSER WATER PUMP ENERGY

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

5249
445
5694

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST CHILLED AND CONDENSER WATER PUMP ENERGY COST

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

20998
5224
26222

ENERGY CONSUMPTION

5694 MBTU

COST

\$26,222

NET ENERGY SAVINGS

18517 MBTU

NET DOLLAR SAVINGS

\$74,929

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 10:07:3

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93

Current UPB/CSI ID: ORL290

M - C A C E S E D I T I O N
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6732-3
3-111

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

TIME 10:07:38

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DETAILED ESTIMATE

DETAIL PAGE

1. BUILDING TO THE 5 FOOT LINE	
AA. ELECTRICAL.....	1
BA. MECHANICAL.....	2

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Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 10:07:38

DETAILED ESTIMATE

DETAIL PAGE 2

BASE BIL

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16050 BASIC MATERIALS AND METHODS									
16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION.									
ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	*** UNIT COSTS: ***			0.14	4.07	0.02	1.70	0.09	5.88
WC=1100	100.00 LF EELEF			14	407	2	170	9	588
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER									
CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	*** UNIT COSTS: ***			19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30 MLF EELEF			6	178	1	248	12	438
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	*** UNIT COSTS: ***			50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00 EA EELEA			50	1,651	0	12,000	600	14,251
TOTAL DIVISION 16 ELECTRICAL				69	2,235	3	12,418	621	15,277
TOTAL FACILITY AA. ELECTRICAL				69	2,235	3	12,418	621	15,277

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6732-3
 3-113

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 10:07:38

TAILED ESTIMATE

DETAIL PAGE 2

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.79
WC=0800	100.00 LF MSPFE			17	459	18	383	19	879
CD=4 HV 2305 6 IN (150MM) P.E. SCH 40	*** UNIT COSTS: ***			0.32	8.89	0.34	8.44	0.42	18.09
WC=0800	100.00 LF MSPFE			32	889	34	844	42	1,809
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2323 6 IN	*** UNIT COSTS: ***			5.78	159.21	6.08	27.20	1.36	193.85
WC=0800	16.00 EA MSPFE			92	2,547	97	435	22	3,102
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2343 6 IN	*** UNIT COSTS: ***			8.70	239.51	9.14	37.50	1.88	288.02
WC=0800	4.00 EA MSPFE			35	958	37	150	8	1,152
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9101 6" TRIPLE DUTY VALVES	*** UNIT COSTS: ***			3.33	99.77	1.34	1015.00	50.75	1166.86
WC=0900	2.00 EA MSPFA			7	200	3	2,030	102	2,334
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92M) FOR EACH FITTING PLUS 4 LF (1.2M) FOR EACH FLANGED JOINT									
CD=4 HV 1011 6 IN DIA. PIPE, 1-1/2 IN THK	*** UNIT COSTS: ***			0.11	3.30	0.04	3.17	0.16	6.67
WC=0800	100.00 LF AASBC			11	330	4	317	16	667
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3001 320 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			258	7078.85	514.85	156800.00	7840	172233.69
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPPO			258	7,079	515	156,800	7,840	172,234
15670 5000 PUMPS									
CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	3000.00	150.00	3453.33
WC=0900 CASE PUMP	2.00 EA MSPFA			20	599	8	6,000	300	6,907
TOTAL DIVISION 15 MECHANICAL				472	13,060	715	166,959	8,348	189,082
TOTAL FACILITY BA. MECHANICAL				472	13,060	715	166,959	8,348	189,082

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6732-3
3-114

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 10:07:38

DETAILED ESTIMATE

DETAIL PAGE 3

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	DOM CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT \$
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	541		15,295		717	179,377	8,969	204,359
TOTAL BASE BID	541		15,295		717	179,377	8,969	204,359
TOTAL ADDITIVE	0		0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	541		15,295		717	179,377	8,969	204,359

*** END OF DETAIL REPORT ***

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

TIME 10:07:38

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

TIME 10:07:38

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.22
BA	MECHANICAL	1.00 EA	189,082	10.0% 18,908	0.0% 0	7.5% 15,599	2.5% 5,590	0.0% 0	229,179	229179.31
BID ITEM TOTAL		1.00 EA	204,359	20,436	0	16,860	6,041	0	247,696	247695.53
TOTAL BASE BID			204,359	20,436	0	16,860	6,041	0	247,696	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			204,359	20,436	0	16,860	6,041	0	247,696	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6732-3
 3-117

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

TIME 10:07:38

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
1.	BUILDING TO THE 5 FOOT LINE	1.00	EA	247,696		247,696	247695.50
	TOTAL CURRENT CONTRACT COST			247,696	0	247,696	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			247,696	0	247,696	
	Government-Furnished Property			0		0	
	SUBTOTAL			247,696	0	247,696	
	Contingencies	7.0%		17,339	0	17,339	
	SUBTOTAL			265,034	0	265,034	
	SIOH (S&A)	5.5%		14,577	0	14,577	
	CURRENT WORKING ESTIMATE			279,611	0	279,611	
	Estimated Construction Time	365	Days				

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS H-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

TIME 10:07:38

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT *	** SUBCON *	W/OH&P	SUBTOTAL
										AMOUNT	PCT		
AA	GENERAL/PRIME		1.00	EA	541	15,295	717	188,346		204,359	100.0%	0	204,359
	TOTAL DIRECT				541	15,295	717	188,346		204,359	100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6732-3
3-119

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

TIME 10:07:30

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 1

ID	CONTRACTOR	PK	SUBTOTAL	*** OVERHEAD *** AMOUNT	PCT	HOPC%	**** PROFIT **** AMOUNT	PCT	BOND% OTHER%	***** TOTAL CONTRACT ***** AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		204,359	20,436	10.0%	0.0	16,860	7.5%	2.5% 0.0%	247,696	100.0%	247695.54
	TOTAL OVERHEAD & PROFIT			20,436	10.0%		16,860	7.5%				

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6732-3
3-120

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

TIME 10:07:38

DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	472	13,060	715	166,959	8,348	189,082
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

TIME 10:07:38

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	187	5,183	189	2,129	106	7,608
09 HEATING, VENTILATION & AIR CONDIT	285	7,877	526	164,830	8,242	181,474
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6732-3
3-122

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

TIME 10:07:38

EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP	DESCRIPTION	LIFE HRS	TL	HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY	UPB	HOURS	TOTAL	COST
ECR25	CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63		12		303
EMI20	SMALL TOOLS								1.40	1.40		143		200
EWEL0	WELDING MACHINE, ELEC, 300 AMP (1.62	1.62		132		214
												288	717	
TOTAL PROJECT EQUIPMENT HOURS														

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6732 OPTION 3

TIME 10:07:38

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT	DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LASBW	ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	11	330
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	62	1,505
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	12	403
LSPFI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	387	10,821
TOTAL PROJECT MANHOURS									541	15,295

* * * END OF SUMMARY REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6732-3
3-124

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6910
 TYPE/SIZE: Carrier Single Stage Absorption Chiller/305 Tons
 MODEL/SERIAL NUMBER: 16JB032-604741407338
 PUMPS: Two 15 HP Chilled Water, Two 15 HP Condenser Water
 PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3660000	100	0.31	34
95/99	25	3660000	100	0.31	422
90/94	111	3660000	100	0.31	1872
85/89	352	3660000	90	0.31	5343
80/84	511	3660000	80	0.31	6895
75/79	664	3660000	67	0.31	7504
70/74	866	3660000	52	0.31	7595
65/69	693	3660000	43	0.31	5026
60/64	471	3660000	35	0.31	2780
55/59	299	3660000	30	0.31	1513
50/54	197	3660000	25	0.31	831
45/49	111	3660000	10	0.31	187
40/44	69	3660000	0	0.31	0

ABSORPTION CHILLER BASELINE ENERGY
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
 TOTAL BASELINE ENERGY

40002
 667
 40669

ABSORPTION CHILLER BASELINE ENERGY COST
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
 TOTAL BASELINE ENERGY COST

180007
 7836
 167843

ENERGY CONSUMPTION

40669 MBTU

COST

\$167,843

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6910
TYPE/SIZE: New Natural Gas Engine Driven Chiller/305 Tons
PUMPS: Two 15 HP Chilled Water, Two 10 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3660000	100	2	4
95/99	25	3660000	100	2	46
90/94	111	3660000	100	2	203
85/89	352	3660000	90	1.92	604
80/84	511	3660000	80	1.85	809
75/79	684	3660000	67	1.75	930
70/74	886	3660000	52	1.87	987
65/69	693	3660000	43	1.65	661
60/64	471	3660000	35	1.56	387
55/59	299	3660000	30	1.5	219
50/54	197	3660000	25	1.45	124
45/49	111	3660000	10	1.36	30
40/44	69	3660000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY
CHILLED AND CONDENSER WATER PUMP ENERGY
TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

5003
556
5560

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST
CHILLED AND CONDENSER WATER PUMP ENERGY COST
TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

20014
6530
26544

ENERGY CONSUMPTION 5560 MBTU COST \$26,544

NET ENERGY SAVINGS 35110 MBTU NET DOLLAR SAVINGS \$141,300

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 10:35:01

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93
Current UPB/CSI ID: ORL290

M - C A C E S E D I T I O N
COMPOSER Plus Copyright (C) 1985, 1988
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6910-3
3-127

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

TIME 10:35:01

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DETAILED ESTIMATE

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Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 10:35:01

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT
16050 BASIC MATERIALS AND METHODS									
16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION.									
ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	***	UNIT COSTS: ***		0.14	4.07	0.02	1.70	0.09	5.81
WC=1100	100.00	LF EELEF		14	407	2	170	9	581
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER									
CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	***	UNIT COSTS: ***		19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30	MLF EELEF		6	178	1	248	12	438
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	***	UNIT COSTS: ***		50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00	EA EELEA		50	1,651	0	12,000	600	14,251
TOTAL DIVISION 16 ELECTRICAL				69	2,235	3	12,418	621	15,271
TOTAL FACILITY AA. ELECTRICAL				69	2,235	3	12,418	621	15,271

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6910-3
 3-129

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 10:35:01

TAILED ESTIMATE

DETAIL PAGE 2

BASE BID

DIVISION 15 MECHANICAL

QUANTITY UOM CREW

MANHR

LABOR

EQUIPMENT

MATERIAL

SALESTX

DIRECT \$

15050 BASIC MATERIALS AND METHODS

15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS

CD=4 HV 2302 3 IN (80MM) P.E. SCH 40
 WC=0800

*** UNIT COSTS: ***
 100.00 LF MSPFE

0.17
 17

4.59
 459

0.18
 18

3.83
 383

0.19
 19

8.79
 879

CD=4 HV 2305 6 IN (150MM) P.E. SCH 40
 WC=0800

*** UNIT COSTS: ***
 100.00 LF MSPFE

0.32
 32

8.89
 889

0.34
 34

8.44
 844

0.42
 42

18.09
 1,809

15061 2320 90 DEGREE LR WELD ELL STD. WT.

CD=4 HV 2323 6 IN
 WC=0800

*** UNIT COSTS: ***
 16.00 EA MSPFE

5.78
 92

159.21
 2,547

6.08
 97

27.20
 435

1.36
 22

193.85
 3,102

15061 2340 TEE FULL SIZE BUTT WELD STD WT.

CD=4 HV 2343 6 IN
 WC=0800

*** UNIT COSTS: ***
 4.00 EA MSPFE

8.70
 35

239.51
 958

9.14
 37

37.50
 150

1.88
 8

288.02
 1,152

15100 9100 TRIPLE DUTY VALVES

CD=3 HV 9101 6" TRIPLE DUTY VALVES
 WC=0900

*** UNIT COSTS: ***
 2.00 EA MSPFA

3.33
 7

99.77
 200

1.34
 3

1015.00
 2,030

50.75
 102

1166.86
 2,334

15180 INSULATION

15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT
 JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF
 (.92M) FOR EACH FITTING PLUS 4 LF (1.2M) FOR EACH FLANGED JOINT

CD=4 HV 1011 6 IN DIA. PIPE, 1-1/2 IN TEK
 WC=0800

*** UNIT COSTS: ***
 100.00 LF AASBC

0.11
 11

3.30
 330

0.04
 4

3.17
 317

0.16
 16

6.67
 667

15650 REFRIGERATION

15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS

CD=3 HV 3001 320 TON NAT GAS ENGINE INCLUDING
 WC=0900 EXISTING CHILLER DEMOLITION

*** UNIT COSTS: ***
 1.00 EA MSPFO

258
 258

7078.85
 7,079

514.85
 515

156800.00
 156,800

7840
 7,840

172233.69
 172,234

15670 5000 PUMPS

CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT
 WC=0900 CASE PUMP

*** UNIT COSTS: ***
 2.00 EA MSPFA

10.00
 20

299.30
 599

4.03
 8

3000.00
 6,000

150.00
 300

3453.33
 6,907

TOTAL DIVISION 15 MECHANICAL

472

13,060

715

166,959

8,348

189,082

TOTAL FACILITY BA. MECHANICAL

472

13,060

715

166,959

8,348

189,082

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6910-3
3-130

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 10:35:01

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	541			15,295		717	179,377	8,969	204,359
TOTAL BASE BID	541			15,295		717	179,377	8,969	204,359
TOTAL ADDITIVE	0			0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	541			15,295		717	179,377	8,969	204,359

*** END OF DETAIL REPORT ***

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6910-1
3-131

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

TIME 10:35:01

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

TIME 10:35:01

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OPC	PROFIT	BOND	OTHER PCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.22
BA	MECHANICAL	1.00 EA	189,082	10.0% 18,908	0.0% 0	7.5% 15,599	2.5% 5,590	0.0% 0	229,179	229179.31
BID ITEM TOTAL		1.00 EA	204,359	20,436	0	16,860	6,041	0	247,696	247695.53
TOTAL BASE BID			204,359	20,436	0	16,860	6,041	0	247,696	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			204,359	20,436	0	16,860	6,041	0	247,696	

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

TIME 10:35:01

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
	1. BUILDING TO THE 5 FOOT LINE	1.00	EA	247,696		247,696	247695.50
	TOTAL CURRENT CONTRACT COST			247,696	0	247,696	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 .0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			247,696	0	247,696	
	Government-Furnished Property			0		0	
	SUBTOTAL			247,696	0	247,696	
	Contingencies	7.0%		17,339	0	17,339	
	SUBTOTAL			265,034	0	265,034	
	SIOH (S&A)	5.5%		14,577	0	14,577	
	CURRENT WORKING ESTIMATE			279,611	0	279,611	
	Estimated Construction Time	365	Days				

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6910-3
 3-134

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

TIME 10:35:0

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE

ID	CONTRACTOR	PM	QUANTITY	DOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT	** SUBCON	W/OH&P	SUBTOTAL
										AMOUNT	PCT		
AA	GENERAL/PRIME		1.00	EA	541	15,295	717	188,346		204,359	100.0%	0	204,359
	TOTAL DIRECT				541	15,295	717	188,346		204,359	100.0%		

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

TIME 10:35:01

TRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PM	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOFC%	**** PROFIT ****	AMOUNT	PCT	BOND%	OTHER%	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		204,359	20,436	10.0%	0.0		16,860	7.5%	2.5%	0.0%		247,696	100.0%		247695.54
	TOTAL OVERHEAD & PROFIT			20,436	10.0%			16,860	7.5%							

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6910-3
3-136

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

TIME 10:35:01

CSI DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	472	13,060	715	166,959	8,348	189,082
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6910-3
3-137

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

TIME 10:35:01

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	187	5,183	189	2,129	106	7,608
09 HEATING, VENTILATION & AIR CONDIT	285	7,877	526	164,830	8,242	181,474
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6910-3
3-138

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

TIME 10:35:01

EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
ECR25 CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	25	606
EMI20 SMALL TOOLS								1.40	1.40	286	401
EWEL0 WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	264	428
										575	1,435
TOTAL PROJECT EQUIPMENT HOURS											

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6910 OPTION 3

TIME 10:35:01

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT	DESCRIPTION	BASE	OVERTH	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LASBW	ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	21	660
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	139	4,470
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	123	3,011
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	25	806
LSPFI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	775	21,643
TOTAL PROJECT MANHOURS									1082	30,590

* * * END OF SUMMARY REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6910-3
3-140

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6921A
 TYPE/SIZE: Carrier Single Stage Absorption Chiller/570 Tons
 MODEL/SERIAL NUMBER: 16JB057-604/FCK6921A-83506
 PUMPS: Two 25 HP Chilled Water, Two 50 HP Condenser Water
 PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	6840000	100	0.405	48
95/99	25	6840000	100	0.405	603
90/94	111	6840000	100	0.405	2678
85/89	352	6840000	90	0.405	7643
80/84	511	6840000	80	0.405	9663
75/79	664	6840000	67	0.405	10734
70/74	866	6840000	52	0.405	10865
65/69	693	6840000	43	0.405	7190
60/64	471	6840000	35	0.405	3977
55/59	299	6840000	30	0.405	2164
50/54	197	6840000	25	0.405	1188
45/49	111	6840000	10	0.405	268
40/44	69	6840000	0	0	0

ABSORPTION CHILLER BASELINE ENERGY
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
 TOTAL BASELINE ENERGY

57222
 1669
 58890

ABSORPTION CHILLER BASELINE ENERGY COST
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
 TOTAL BASELINE ENERGY COST

228887
 19591
 248477

ENERGY CONSUMPTION

58890 MBTU

COST

\$248,477

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6921A
TYPE/SIZE: New Natural Gas Engine Driven Chiller/570 Tons
PUMPS: Two 25 HP Chilled Water, One 50 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	8840000	100	2	7
95/99	25	8840000	100	2	88
90/84	111	8840000	100	2	380
85/89	352	8840000	90	1.92	1129
80/84	511	8840000	80	1.85	1511
75/79	664	8840000	67	1.75	1739
70/74	866	8840000	52	1.67	1844
65/69	893	8840000	43	1.65	1235
60/64	471	8840000	35	1.58	723
55/59	299	8840000	30	1.5	409
50/54	197	8840000	25	1.45	232
45/49	111	8840000	10	1.38	56
40/44	59	8840000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CHILLED AND CONDENSER WATER PUMP ENERGY

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

9351
1112
10463

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST CHILLED AND CONDENSER WATER PUMP ENERGY COST

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

37402
13080
50463

ENERGY CONSUMPTION

10463 MBTU

COST

\$50,463

NET ENERGY SAVINGS

48427 MBTU

NET DOLLAR SAVINGS

\$198,015

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 13:25:22

FILE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93
Current UPB/CSI ID: ORL290

M - C A C E S E D I T I O N
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6921-3
3-143

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

TIME 13:25:22

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DETAILED ESTIMATE

DETAIL PAGE

1. BUILDING TO THE 5 FOOT LINE	
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* * * END TABLE OF CONTENTS * * *

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 13:25:21

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BIL

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT %
------------------------	----------	-----	------	-------	-------	-----------	----------	---------	----------

16050 BASIC MATERIALS AND METHODS

16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION.
 ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT

CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	*** UNIT COSTS: ***	0.14	4.07	0.02	1.70	0.09	5.88
WC=1100	100.00 LF EELEF	14	407	2	170	9	588

16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER
 CONDUCTOR, PULLED IN COND

CD=4 EL 1711 NO 2/0 TYPE THWN	*** UNIT COSTS: ***	19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30 MLF EELEF	6	178	1	248	12	438

16900 CONTROLS AND INSTRUMENTATION

16950 2000 CHILLER CONTROLS

CD=3 EL 2001 CHILLER CONTROL PACKAGE	*** UNIT COSTS: ***	50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00 EA EELEA	50	1,651	0	12,000	600	14,251

TOTAL DIVISION 16 ELECTRICAL

69	2,235	3	12,418	621	15,277
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TOTAL FACILITY AA. ELECTRICAL

69	2,235	3	12,418	621	15,277
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Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 13:25:22

TAILED ESTIMATE

DETAIL PAGE 2

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT \$
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.79
WC=0800	100.00 LF MSPFE			17	459	18	383	19	879
CD=4 HV 2306 8 IN (200MM) P.E. SCH 40	*** UNIT COSTS: ***			0.40	10.55	0.69	13.19	0.66	25.09
WC=0800	100.00 LF MSPFH			40	1,055	69	1,319	66	2,509
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2324 8 IN	*** UNIT COSTS: ***			8.13	214.34	13.99	50.71	2.54	281.56
WC=0800	16.00 EA MSPFH			130	3,429	224	811	41	4,505
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2344 8 IN	*** UNIT COSTS: ***			12.38	326.61	21.32	69.45	3.47	420.86
WC=0800	4.00 EA MSPFH			50	1,306	85	278	14	1,683
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9102 8" TRIPLE DUTY VALVE	*** UNIT COSTS: ***			4.00	119.72	1.61	1308.00	65.40	1494.73
WC=0900	2.00 EA MSPFA			8	239	3	2,616	131	2,989
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92M) FOR EACH FITTING PLUS 4 LF (1.2M) FOR EACH FLANGED JOINT									
CD=4 HV 1012 8 IN DIA. PIPE, 2 IN THK	*** UNIT COSTS: ***			0.13	4.18	0.05	5.99	0.30	10.52
WC=0800	100.00 LF AASBC			13	418	5	599	30	1,052
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3006 570 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			258	7078.85	514.85	279300.00	13965	300858.69
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPFO			258	7,079	515	279,300	13,965	300,859
15670 5000 PUMPS									
CD=3 HV 5002 15 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	6000.00	300.00	6603.33
WC=0900 CASE PUMP	2.00 EA MSPFA			20	599	8	12,000	600	13,207
TOTAL DIVISION 15 MECHANICAL				536	14,585	927	297,306	14,865	327,684
TOTAL FACILITY BA. MECHANICAL				536	14,585	927	297,306	14,865	327,684

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6921-3
3-146

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 13:25:22

TAILED ESTIMATE

DETAIL PAGE 3

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	605			16,821		929	309,724	15,486	342,960
TOTAL BASE BID	605			16,821		929	309,724	15,486	342,960
TOTAL ADDITIVE	0			0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	605			16,821		929	309,724	15,486	342,960

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6921-3
3-147

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

TIME 13:25:22

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

TIME 13:25:22

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.22
BA	MECHANICAL	1.00 EA	327,684	10.0% 32,768	0.0% 0	7.5% 27,034	2.5% 9,687	0.0% 0	397,173	397173.02
BID ITEM TOTAL		1.00 EA	342,960	34,296	0	28,294	10,139	0	415,689	415689.23
TOTAL BASE BID			342,960	34,296	0	28,294	10,139	0	415,689	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			342,960	34,296	0	28,294	10,139	0	415,689	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6921-3
 3-149

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

TIME 13:25:21

PROJECT CWE SUMMARY

SUMMARY PAGE 1

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
	1. BUILDING TO THE 5 FOOT LINE	1.00	EA	415,689		415,689	415689.20
	TOTAL CURRENT CONTRACT COST			415,689	0	415,689	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			415,689	0	415,689	
	Government-Furnished Property			0		0	
	SUBTOTAL			415,689	0	415,689	
	Contingencies	7.0%		29,098	0	29,098	
	SUBTOTAL			444,787	0	444,787	
	SIOH (S&A)	5.5%		24,463	0	24,463	
	CURRENT WORKING ESTIMATE			469,251	0	469,251	
	Estimated Construction Time	365	Days				

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

TIME 13:25:22

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	DOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	AMOUNT	PCT	W/OH&P	SUBTOTAL
AA	GENERAL/PRIME		1.00	EA	605	16,821	929	325,210		342,960	100.0%	0	342,960
	TOTAL DIRECT				605	16,821	929	325,210		342,960	100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6921-3
3-151

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

TIME 13:25:22

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PM	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOFC%	**** PROFIT ****	AMOUNT	PCT	BOND%	OTHER%	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		342,960		34,296	10.0%	0.0		28,294	7.5%	2.5%	0.0%		415,689	100.0%	415689.24
	TOTAL OVERHEAD & PROFIT				34,296	10.0%			28,294	7.5%						

01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

TIME 13:25:2

CSI DIVISION SUMMARY

SUMMARY PAGE

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	536	14,585	927	297,306	14,865	327,684
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	605	16,821	929	309,724	15,486	342,960

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

TIME 13:25:22

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	250	6,668	401	3,390	170	10,629
09 HEATING, VENTILATION & AIR CONDIT	286	7,917	526	293,916	14,696	317,055
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	605	16,821	929	309,724	15,486	342,960

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6921-3
3-154

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

TIME 13:25:22

EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP	DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
ECR25	CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	12	303
EMI20	SMALL TOOLS								1.40	1.40	154	215
EWEL0	WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	68	111
EWEL20	WELDING MACHINE,GASOLINE, 200 AM								4.45	4.45	68	301
											302	930
TOTAL PROJECT EQUIPMENT HOURS												

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6921-3
3-155

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6921A OPT 3

TIME 13:25:22

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT	DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LASBW	ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	13	418
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	129	3,158
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	12	403
LSPTI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	381	10,607
TOTAL PROJECT MANHOURS									605	16,821

* * * END OF SUMMARY REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6921-3
3-156

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6929
 TYPE/SIZE: Carrier Single Stage Absorption Chiller/320 Tons
 MODEL/SERIAL NUMBER: 16JB032-60474047337
 PUMPS: Two 15 HP Chilled Water, Two 15 HP Condenser Water
 PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3840000	100	0.31	35
95/99	25	3840000	100	0.31	442
90/94	111	3840000	100	0.31	1984
85/89	352	3840000	90	0.31	5606
80/84	511	3840000	80	0.31	7234
75/79	664	3840000	67	0.31	7873
70/74	866	3840000	52	0.31	7969
65/69	693	3840000	43	0.31	5273
60/64	471	3840000	35	0.31	2917
55/59	299	3840000	30	0.31	1587
50/54	197	3840000	25	0.31	872
45/49	111	3840000	10	0.31	196
40/44	69	3840000	0	0.31	0

ABSORPTION CHILLER BASELINE ENERGY
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
 TOTAL BASELINE ENERGY

41969
 667
 42637

ABSORPTION CHILLER BASELINE ENERGY COST
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
 TOTAL BASELINE ENERGY COST

167876
 7836
 175713

ENERGY CONSUMPTION

42637 MBTU

COST

\$175,713

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6929
TYPE/SIZE: New Natural Gas Engine Driven Chiller/320 Tons
PUMPS: Two 15 HP Chilled Water, Two 10 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3840000	100	2	4
95/99	25	3840000	100	2	48
90/94	111	3840000	100	2	213
85/89	352	3840000	90	1.92	634
80/84	511	3840000	80	1.85	849
75/79	664	3840000	67	1.75	976
70/74	866	3840000	62	1.87	1035
65/69	693	3840000	43	1.65	694
60/64	471	3840000	35	1.56	406
55/59	299	3840000	30	1.5	230
50/54	197	3840000	25	1.45	130
45/49	111	3840000	10	1.36	31
40/44	69	3840000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CHILLED AND CONDENSER WATER PUMP ENERGY

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

5249
556
5806

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST CHILLED AND CONDENSER WATER PUMP ENERGY COST

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

20898
6530
27528

ENERGY CONSUMPTION 5806 MBTU COST \$27,528

NET ENERGY SAVINGS 36831 MBTU NET DOLLAR SAVINGS \$148,185

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 10:42:38

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93

Current UPB/CSI ID: ORL290

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CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6929-3
3-159

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

TIME 10:42:38

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Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 10:42:38

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16050 BASIC MATERIALS AND METHODS									
16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION.									
ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	*** UNIT COSTS: ***			0.14	4.07	0.02	1.70	0.09	5.88
WC=1100	100.00 LF EELEF			14	407	2	170	9	588
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER									
CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	*** UNIT COSTS: ***			19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30 MLF EELEF			6	178	1	248	12	438
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	*** UNIT COSTS: ***			50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00 EA EELEA			50	1,651	0	12,000	600	14,251
TOTAL DIVISION 16 ELECTRICAL				69	2,235	3	12,418	621	15,277
TOTAL FACILITY AA. ELECTRICAL				69	2,235	3	12,418	621	15,277

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6929-3
3-161

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 10:42:38

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BII

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.79
WC=0800	100.00 LF MSPFE			17	459	18	383	19	879
CD=4 HV 2305 6 IN (150MM) P.E. SCH 40	*** UNIT COSTS: ***			0.32	8.89	0.34	8.44	0.42	18.09
WC=0800	100.00 LF MSPFE			32	889	34	844	42	1,809
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2323 6 IN	*** UNIT COSTS: ***			5.78	159.21	6.08	27.20	1.36	193.85
WC=0800	16.00 EA MSPFE			92	2,547	97	435	22	3,102
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2343 6 IN	*** UNIT COSTS: ***			8.70	239.51	9.14	37.50	1.88	288.02
WC=0800	4.00 EA MSPFE			35	958	37	150	8	1,152
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9101 6" TRIPLE DUTY VALVES	*** UNIT COSTS: ***			3.33	99.77	1.34	1015.00	50.75	1166.86
WC=0900	2.00 EA MSPFA			7	200	3	2,030	102	2,334
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92M) FOR EACH FITTING PLUS 4 LF (1.2M) FOR EACH FLANGED JOINT									
CD=4 HV 1011 6 IN DIA. PIPE, 1-1/2 IN THK	*** UNIT COSTS: ***			0.11	3.30	0.04	3.17	0.16	6.67
WC=0800	100.00 LF AASBC			11	330	4	317	16	667
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3001 320 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			258	7078.85	514.85	156800.00	7840	172233.69
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPFO			258	7,079	515	156,800	7,840	172,234
15670 5000 PUMPS									
CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	3000.00	150.00	3453.33
WC=0900 CASE PUMP	2.00 EA MSPFA			20	599	8	6,000	300	6,907
TOTAL DIVISION 15 MECHANICAL				472	13,060	715	166,959	8,348	189,082
TOTAL FACILITY BA. MECHANICAL				472	13,060	715	166,959	8,348	189,082

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6929-3
3-162

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 10:42:38

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	541			15,295		717	179,377	8,969	204,358
TOTAL BASE BID	541			15,295		717	179,377	8,969	204,358
TOTAL ADDITIVE	0			0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	541			15,295		717	179,377	8,969	204,358

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6929-3
3-163

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

TIME 10:42:38

SUMMARY PAGE 1

PROJECT NOTES

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

TIME 10:42:38

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.22
BA	MECHANICAL	1.00 EA	189,082	10.0% 18,908	0.0% 0	7.5% 15,599	2.5% 5,590	0.0% 0	229,179	229179.31
BID ITEM TOTAL		1.00 EA	204,359	20,436	0	16,860	6,041	0	247,696	247695.53
TOTAL BASE BID			204,359	20,436	0	16,860	6,041	0	247,696	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			204,359	20,436	0	16,860	6,041	0	247,696	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6929-3
 3-165

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

TIME 10:42:38

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
1.	BUILDING TO THE 5 FOOT LINE	1.00	EA	247,696		247,696	247695.50
	TOTAL CURRENT CONTRACT COST			247,696	0	247,696	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			247,696	0	247,696	
	Government-Furnished Property			0		0	
	SUBTOTAL			247,696	0	247,696	
	Contingencies	7.0%		17,339	0	17,339	
	SUBTOTAL			265,034	0	265,034	
	SIOH (S&A)	5.5%		14,577	0	14,577	
	CURRENT WORKING ESTIMATE			279,611	0	279,611	

Estimated Construction Time 365 Days

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6929-3
3-166

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

TIME 10:42:38

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	DOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT *	** SUBCON *	W/OH&P	SUBTOTAL
										AMOUNT	PCT		
AA	GENERAL/PRIME		1.00	EA	541	15,295	717	188,346		204,359	100.0%	0	204,359
	TOTAL DIRECT				541	15,295	717	188,346		204,359	100.0%		

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

TIME 10:42:38

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PM	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOF%	**** PROFIT ****	AMOUNT	PCT	BOND%	OTHER%	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		204,359	20,436	10.0%	0.0		16,860	7.5%	2.5%	0.0%		247,696	100.0%		247695.54
	TOTAL OVERHEAD & PROFIT			20,436	10.0%			16,860	7.5%							

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6929-3
3-168

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

TIME 10:42:38

I DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	472	13,060	715	166,959	8,348	189,082
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

TIME 10:42:38

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	187	5,183	189	2,129	106	7,608
09 HEATING, VENTILATION & AIR CONDIT	285	7,877	526	164,830	8,242	181,474
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6929-3
3-170

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

TIME 10:42:38

EQUIPMENT SUMMARY

SUMMARY PAGE 8

----- *** BOOK VALUE ***		ADJ FACTOR	ADJUSTD	BOOK OP	--	HRLY	---	UPB	****	TOTAL	****		
EQUIP	DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTH	OWNRSH	EXPENSE	RATE	RATE	HOURS	COST	
ECR25	CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	12	303	
ENI20	SMALL TOOLS								1.40	1.40	143	200	
EWEL0	WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	132	214	
TOTAL PROJECT EQUIPMENT HOURS												288	717

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6929 OPTION 3

TIME 10:42:38

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	**** TOTAL COST
LASBW ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	11	330
LELEC ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	62	1,505
LOEME EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	12	403
LSPFI STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	387	10,821
TOTAL PROJECT MANHOURS								541	15,295

*** END OF SUMMARY REPORT ***

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6929-3
3-172

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6936
 TYPE/SIZE: Carrier Single Stage Absorption Chiller/180 Tons
 MODEL/SERIAL NUMBER: 16JB018-604/734307182
 PUMPS: One 5 HP Chilled Water, One 10 HP Condenser Water
 PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	2160000	100	0.49	13
95/99	25	2160000	100	0.49	157
90/94	111	2160000	100	0.49	699
85/89	352	2160000	90	0.49	1995
80/84	511	2160000	80	0.49	2574
75/79	664	2160000	67	0.49	2802
70/74	866	2160000	52	0.49	2838
65/69	693	2160000	43	0.49	1877
60/64	471	2160000	35	0.49	1038
55/59	299	2160000	30	0.49	565
50/54	187	2160000	25	0.49	310
45/49	111	2160000	10	0.49	70
40/44	69	2160000	0	0	0

ABSORPTION CHILLER BASELINE ENERGY
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
 TOTAL BASELINE ENERGY

14935
 167
 15102

ABSORPTION CHILLER BASELINE ENERGY COST
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
 TOTAL BASELINE ENERGY COST

59742
 1959
 61701

ENERGY CONSUMPTION

15102 MBTU

COST

\$61,701

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6936
TYPE/SIZE: New Natural Gas Engine Driven Chiller/180 Tons
PUMPS: One 5 HP Chilled Water, One 10 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	2160000	100	2	2
95/99	25	2160000	100	2	27
90/94	111	2160000	100	2	120
85/89	352	2160000	90	1.92	356
80/84	511	2160000	80	1.85	477
75/79	664	2160000	67	1.75	549
70/74	866	2160000	52	1.67	582
65/69	893	2160000	43	1.65	390
60/64	471	2160000	35	1.56	228
55/59	299	2160000	30	1.5	129
50/54	197	2160000	25	1.45	73
45/49	111	2160000	10	1.36	16
40/44	69	2160000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CHILLED AND CONDENSER WATER PUMP ENERGY

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

2953
187
3120

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST CHILLED AND CONDENSER WATER PUMP ENERGY COST

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

11811
1959
13770

ENERGY CONSUMPTION 3120 MBTU COST \$13,770

NET ENERGY SAVINGS 11983 MBTU NET DOLLAR SAVINGS \$47,930

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 14:05:31

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93

Current UPB/CSI ID: ORL290

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CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6936-3
3-175

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

TIME 14:05:31

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DETAILED ESTIMATE DETAIL PAGE

1. BUILDING TO THE 5 FOOT LINE	
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Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 14:05:31

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16050 BASIC MATERIALS AND METHODS									
16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION.									
ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	*** UNIT COSTS: ***			0.14	4.07	0.02	1.70	0.09	5.88
WC=1100	100.00 LF EELEF			14	407	2	170	9	588
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER									
CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	*** UNIT COSTS: ***			19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30 MLF EELEF			6	178	1	248	12	438
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	*** UNIT COSTS: ***			50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00 EA EELEA			50	1,651	0	12,000	600	14,251
TOTAL DIVISION 16 ELECTRICAL					69	2,235	3	12,418	621 15,277
TOTAL FACILITY AA. ELECTRICAL					69	2,235	3	12,418	621 15,277

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6936-3
 3-177

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / PT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 14:05:31

DETAILED ESTIMATE

DETAIL PAGE 2

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.79
WC=0800	100.00 LF MSPFE		17	459	18	383	19		879
CD=4 HV 2303 4 IN (100MM) P.E. SCH 40	*** UNIT COSTS: ***			0.22	5.92	0.23	5.42	0.27	11.84
WC=0800	100.00 LF MSPFE		22	592	23	542	27		1,184
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2322 4 IN	*** UNIT COSTS: ***			3.50	96.47	3.68	11.11	0.56	111.62
WC=0800	16.00 EA MSPFE		56	1,544	59	178	9		1,789
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2342 4 IN	*** UNIT COSTS: ***			5.26	144.97	5.53	20.60	1.03	172.13
WC=0800	4.00 EA MSPFE		21	580	22	82	4		689
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9101 6" TRIPLE DUTY VALVES	*** UNIT COSTS: ***			3.33	99.77	1.34	1015.00	50.75	1166.86
WC=0900	2.00 EA MSPFA		7	200	3	2,030	102		2,334
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92M) FOR EACH FITTING PLUS 4 LF (1.2M) FOR EACH FLANGED JOINT									
CD=4 HV 1009 4 IN DIA. PIPE, 1 IN THICK	*** UNIT COSTS: ***			0.08	2.51	0.03	1.91	0.10	4.55
WC=0800	100.00 LF AASBC		8	251	3	191	10		455
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3003 180 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			134	3681.00	267.72	88200.00	4410	96558.72
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPFO		134	3,681	268	88,200	4,410		96,559
15670 5000 PUMPS									
CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	3000.00	150.00	3453.33
WC=0900 CASE PUMP	2.00 EA MSPFA		20	599	8	6,000	300		6,907
TOTAL DIVISION 15 MECHANICAL				284	7,905	403	97,606	4,880	110,794
TOTAL FACILITY BA. MECHANICAL				284	7,905	403	97,606	4,880	110,794

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6936-3
3-178

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 14:05:33

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	DOM CREW	MANER	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT \$
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	354			10,140	405	110,024	5,501	126,071
TOTAL BASE BID	354			10,140	405	110,024	5,501	126,071
TOTAL ADDITIVE	0			0	0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	354			10,140	405	110,024	5,501	126,071

*** END OF DETAIL REPORT ***

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6936-3
3-179

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

TIME 14:05:3

PROJECT NOTES

SUMMARY PAGE

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

TIME 14:05:31

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY	COST TO PRM	OVERHEAD	HOME OPC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516 18516.22
BA	MECHANICAL	1.00 EA	110,794	10.0% 11,079	0.0% 0	7.5% 9,141	2.5% 3,275	0.0% 0	134,289 134289.34
BID ITEM TOTAL		1.00 EA	126,071	12,607	0	10,401	3,727	0	152,806 152805.56
TOTAL BASE BID			126,071	12,607	0	10,401	3,727	0	152,806
TOTAL ADDITIVE			0	0	0	0	0	0	0
TOTAL INCL ADD			126,071	12,607	0	10,401	3,727	0	152,806

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6936-3
 3-181

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

TIME 14:05:31

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
1.	BUILDING TO THE 5 FOOT LINE	1.00	EA	152,806		152,806	152805.60
TOTAL CURRENT CONTRACT COST				152,806	0	152,806	
Cost Growth from 08/93 to 08/94 Index Values: 0000 0000		0.0%		0	0	0	
ESCALATED CONTRACT COST				152,806	0	152,806	
Government-Furnished Property				0		0	
SUBTOTAL				152,806	0	152,806	
Contingencies		7.0%		10,696	0	10,696	
SUBTOTAL				163,502	0	163,502	
SIOH (S&A)		5.5%		8,993	0	8,993	
CURRENT WORKING ESTIMATE				172,495	0	172,495	

Estimated Construction Time 365 Days

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

TIME 14:05:3

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT * AMOUNT PCT	* SUBCON * W/OR&P	SUBTOTAL
AA	GENERAL/PRIME		1.00	EA	354	10,140	405	115,525		126,071 100.0%	0	126,071
	TOTAL DIRECT				354	10,140	405	115,525		126,071 100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6936-3
3-183

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

TIME 14:05:31

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PM	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOFCT	**** PROFIT ****	AMOUNT	PCT	BOND	OTHER	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		126,071	12,607	10.0%	0.0		10,401	7.5%	2.5%	0.0%		152,806	100.0%		152805.55
	TOTAL OVERHEAD & PROFIT			12,607	10.0%			10,401	7.5%							

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6936-3
3-184

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

TIME 14:05:3

SI DIVISION SUMMARY

SUMMARY PAGE

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	284	7,905	403	97,606	4,880	110,794
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	354	10,140	405	110,024	5,501	126,071

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6936-3
3-185

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

TIME 14:05:31

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	123	3,426	124	1,376	69	4,995
09 HEATING, VENTILATION & AIR CONDIT	161	4,479	278	96,230	4,812	105,799
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	354	10,140	405	110,024	5,501	126,071

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6936-3
3-186

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

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EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP	DESCRIPTION	LIFE HRS	TL HRLY	OWNRSHP	OWNS	OVTM	OWNRSHP	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
ECR25	CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	6	158
EMI20	SMALL TOOLS								1.40	1.40	87	121
EWEL0	WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	78	127
TOTAL PROJECT EQUIPMENT HOURS											171	405

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6936 OPTION 3

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BOR SUMMARY

SUMMARY PAGE 9

CRAFT	DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LASBW	ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	8	251
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	32	783
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	6	210
LSPFI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	238	6,662
TOTAL PROJECT MANHOURS									354	10,140

* * * END OF SUMMARY REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6936-3
3-188

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6938
 TYPE/SIZE: Carrier Single Stage Absorption Chiller/320 Tons
 MODEL/SERIAL NUMBER: 16JB032-60474047336
 PUMPS: Two 15 HP Chilled Water, Two 15 HP Condenser Water
 PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3840000	100	0.31	35
95/99	25	3840000	100	0.31	442
90/94	111	3840000	100	0.31	1864
85/89	352	3840000	90	0.31	5606
80/84	511	3840000	80	0.31	7234
75/79	664	3840000	67	0.31	7873
70/74	866	3840000	52	0.31	7969
65/69	693	3840000	43	0.31	5273
60/64	471	3840000	35	0.31	2917
55/59	299	3840000	30	0.31	1587
50/54	197	3840000	25	0.31	872
45/49	111	3840000	10	0.31	196
40/44	69	3840000	0	0.31	0

ABSORPTION CHILLER BASELINE ENERGY
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
 TOTAL BASELINE ENERGY

41969
 667
 42637

ABSORPTION CHILLER BASELINE ENERGY COST
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
 TOTAL BASELINE ENERGY COST

167876
 7836
 175713

ENERGY CONSUMPTION

42637 MBTU

COST

\$175,713

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6938
 TYPE/SIZE: New Natural Gas Engine Driven Chiller/320 Tons
 PUMPS: Two 15 HP Chilled Water, Two 10 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	3840000	100	2	4
95/99	25	3840000	100	2	48
90/94	111	3840000	100	2	213
85/89	352	3840000	90	1.92	634
80/84	511	3840000	80	1.85	848
75/79	664	3840000	67	1.75	976
70/74	866	3840000	52	1.67	1035
65/69	693	3840000	43	1.65	694
60/64	471	3840000	35	1.56	406
55/59	299	3840000	30	1.5	230
50/54	197	3840000	25	1.45	130
45/49	111	3840000	10	1.38	31
40/44	69	3840000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY
 CHILLED AND CONDENSER WATER PUMP ENERGY
 TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

5249
 556
 5806

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST
 CHILLED AND CONDENSER WATER PUMP ENERGY COST
 TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

20998
 6530
 27528

ENERGY CONSUMPTION

5806 MBTU

COST

\$27,528

NET ENERGY SAVINGS

36831 MBTU

NET DOLLAR SAVINGS

\$148,185

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 13:50:53

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93
Current UPB/CSI ID: ORL290

M - C A C E S E D I T I O N
COMPOSER Plus Copyright (C) 1985, 1988
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
3-191

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

TIME 13:50:53

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DETAILED ESTIMATE	DETAIL PAGE
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BA. MECHANICAL.....	2

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Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 13:50:53

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16050 BASIC MATERIALS AND METHODS									
16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION. ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	*** UNIT COSTS: ***			0.14	4.07	0.02	1.70	0.09	5.88
WC=1100	100.00 LF EELEF			14	407	2	170	9	588
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	*** UNIT COSTS: ***			19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30 MLF EELEF			6	178	1	248	12	438
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	*** UNIT COSTS: ***			50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00 EA EELEA			50	1,651	0	12,000	600	14,251
TOTAL DIVISION 16 ELECTRICAL				69	2,235	3	12,418	621	15,277
TOTAL FACILITY AA. ELECTRICAL				69	2,235	3	12,418	621	15,277

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
 3-193

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 13:50:5

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BI

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.79
WC=0800	100.00 LF MSPFE			17	459	18	383	19	879
CD=4 HV 2305 6 IN (150MM) P.E. SCH 40	*** UNIT COSTS: ***			0.32	8.89	0.34	8.44	0.42	18.09
WC=0800	100.00 LF MSPFE			32	889	34	844	42	1,809
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2323 6 IN	*** UNIT COSTS: ***			5.78	159.21	6.08	27.20	1.36	193.85
WC=0800	16.00 EA MSPFE			92	2,547	97	435	22	3,102
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2343 6 IN	*** UNIT COSTS: ***			8.70	239.51	9.14	37.50	1.88	288.02
WC=0800	4.00 EA MSPFE			35	958	37	150	8	1,152
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9101 6" TRIPLE DUTY VALVES	*** UNIT COSTS: ***			3.33	99.77	1.34	1015.00	50.75	1166.86
WC=0900	2.00 EA MSPFA			7	200	3	2,030	102	2,334
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92H) FOR EACH FITTING PLUS 4 LF (1.2H) FOR EACH FLANGED JOINT									
CD=4 HV 1011 6 IN DIA. PIPE, 1-1/2 IN THK	*** UNIT COSTS: ***			0.11	3.30	0.04	3.17	0.16	6.67
WC=0800	100.00 LF AASBC			11	330	4	317	16	667
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3001 320 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			258	7078.85	514.85	156800.00	7840	172233.69
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPFO			258	7,079	515	156,800	7,840	172,234
15670 5000 PUMPS									
CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	3000.00	150.00	3453.33
WC=0900 CASE PUMP	2.00 EA MSPFA			20	599	8	6,000	300	6,907
TOTAL DIVISION 15 MECHANICAL				472	13,060	715	166,959	8,348	189,082
TOTAL FACILITY BA. MECHANICAL				472	13,060	715	166,959	8,348	189,082

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
3-194

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 13:50:53

DETAILED ESTIMATE

DETAIL PAGE 3

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	541			15,295		717	179,377	8,969	204,359
TOTAL BASE BID	541			15,295		717	179,377	8,969	204,359
TOTAL ADDITIVE	0			0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	541			15,295		717	179,377	8,969	204,359

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
3-195

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

TIME 13:50:51

PROJECT NOTES

SUMMARY PAGE 2

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
3-196

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

TIME 13:50:5

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BI

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COS
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.2
BA	MECHANICAL	1.00 EA	189,082	10.0% 18,908	0.0% 0	7.5% 15,599	2.5% 5,590	0.0% 0	229,179	229179.3
BID ITEM TOTAL		1.00 EA	204,359	20,436	0	16,860	6,041	0	247,696	247695.5
TOTAL BASE BID			204,359	20,436	0	16,860	6,041	0	247,696	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			204,359	20,436	0	16,860	6,041	0	247,696	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
 3-197

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

TIME 13:50:5

PROJECT CWE SUMMARY

SUMMARY PAGE 1

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
1.	BUILDING TO THE 5 FOOT LINE	1.00	EA	247,696		247,696	247695.50
	TOTAL CURRENT CONTRACT COST			247,696	0	247,696	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			247,696	0	247,696	
	Government-Furnished Property			0		0	
	SUBTOTAL			247,696	0	247,696	
	Contingencies	7.0%		17,339	0	17,339	
	SUBTOTAL			265,034	0	265,034	
	SIOH (S&A)	5.5%		14,577	0	14,577	
	CURRENT WORKING ESTIMATE			279,611	0	279,611	
	Estimated Construction Time	365	Days				

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
3-198

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

TIME 13:50:53

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT W/TX	** TOTAL DIRECT * AMOUNT PCT	* SUBCON * W/OH&P	SUBTOTAL
AA	GENERAL/PRIME		1.00	EA	541	15,295	717	188,346	204,359 100.0%	0	204,359
	TOTAL DIRECT				541	15,295	717	188,346	204,359 100.0%		

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

TIME 13:50:53

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PM	SUBTOTAL	*** OVERHEAD *** AMOUNT	PCT	HOFC%	**** PROFIT **** AMOUNT	PCT	BOND%	OTHR%	***** TOTAL CONTRACT ***** AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		204,359	20,436	10.0%	0.0	16,860	7.5%	2.5%	0.0%	247,696	100.0%	247695.54
	TOTAL OVERHEAD & PROFIT			20,436	10.0%		16,860	7.5%					

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
3-200

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

TIME 13:50:51

CSI DIVISION SUMMARY

SUMMARY PAGE 1

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	472	13,060	715	166,959	8,348	189,082
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
3-201

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

TIME 13:50:53

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	187	5,183	189	2,129	106	7,608
09 HEATING, VENTILATION & AIR CONDIT	285	7,877	526	164,830	8,242	181,474
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	179,377	8,969	204,359

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
3-202

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

TIME 13:50:53

EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
ECR25 CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	12	303
EMI20 SMALL TOOLS								1.40	1.40	143	200
EWEL0 WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	132	214
TOTAL PROJECT EQUIPMENT HOURS										288	717

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6938 OPTION 3

TIME 13:50:53

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT	DESCRIPTION	BASE	OVERTH	TKS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LASBW	ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	11	330
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	62	1,505
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	12	403
LSPFI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	387	10,821
TOTAL PROJECT MANHOURS									541	15,295

*** END OF SUMMARY REPORT ***

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6938-3
3-204

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6944
 TYPE/SIZE: Trane Single Stage Absorption Chiller/380 Tons
 MODEL/SERIAL NUMBER: C4B2/L2M5000
 PUMPS: Two 25 HP Chilled Water, Two 20 HP Condenser Water
 PAGE 1 OF 5

ABSORPTION CHILLER ENERGY BASELINE

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	4560000	100	0.405	32
95/99	25	4560000	100	0.405	402
90/94	111	4560000	100	0.405	1785
85/89	352	4560000	90	0.405	5096
80/84	511	4560000	80	0.405	6575
75/79	664	4560000	67	0.405	7156
70/74	868	4560000	52	0.405	7243
65/69	693	4560000	43	0.405	4793
60/64	471	4560000	35	0.405	2652
55/59	299	4560000	30	0.405	1443
50/54	197	4560000	25	0.405	792
45/49	111	4560000	10	0.405	179
40/44	69	4560000	0	0	0

ABSORPTION CHILLER BASELINE ENERGY
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY
 TOTAL BASELINE ENERGY

38148
 1001
 39149

ABSORPTION CHILLER BASELINE ENERGY COST
 CHILLED AND CONDENSER WATER PUMP BASELINE ENERGY COST
 TOTAL BASELINE ENERGY COST

152591
 11754
 164346

ENERGY CONSUMPTION

39149 MBTU

COST

\$164,346

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 4: REPLACE ABSORPTION CHILLER WITH HIGH EFFICIENCY UNITS

31 AUGUST 1993

LOCATION: BLDG 6944
 TYPE/SIZE: New Natural Gas Engine Driven Chiller/380 Tons
 PUMPS: Two 25 HP Chilled Water, Two 15 HP Condenser Water

PAGE 4 OF 5

OPTION C: NEW NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CONSUMPTION

BIN	COOLING SEASON OCCURRENCES	FULL LOAD BTU/HR	% FULL LOAD	CHILLER COP	ANNUAL ENERGY CONSUMPTION (MBTU/YR)
100/104	2	4560000	100	2	5
95/99	25	4560000	100	2	57
90/94	111	4560000	100	2	253
85/89	352	4560000	90	1.92	752
80/84	511	4560000	80	1.85	1006
75/79	664	4560000	67	1.75	1159
70/74	866	4560000	52	1.67	1230
65/69	693	4560000	43	1.65	824
60/64	471	4560000	35	1.58	482
55/59	299	4560000	30	1.5	273
50/54	197	4560000	25	1.45	155
45/49	111	4560000	10	1.36	37
40/44	69	4560000	0	0	0

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY CHILLED AND CONDENSER WATER PUMP ENERGY

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY

6234
 890
 7124

NEW NATURAL GAS ENGINE DRIVEN CHILLER ENERGY COST CHILLED AND CONDENSER WATER PUMP ENERGY COST

TOTAL NEW NATURAL GAS ENGINE DRIVEN CHILLER SYSTEM ENERGY COST

24935
 10448
 35383

ENERGY CONSUMPTION

7124 MBTU

COST

\$35,383

NET ENERGY SAVINGS

32025 MBTU

NET DOLLAR SAVINGS

\$128,962

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 14:30:14

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93
Current UPB/CSI ID: ORL290

M - C A C E S E D I T I O N
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6944-3
3-207

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

TIME 14:30:14

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Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 14:30:14

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16050 BASIC MATERIALS AND METHODS									
16111 5100 IMC BRANCH AND FEEDER CONDUIT EXPOSED CONDITION. ALL 1/2 IN AND 3/4 IN ELBOWS ASSUMED TO BE FIELD BENT									
CD=4 EL 5115 2 IN IMC CONDUIT W/COUPLING	***	UNIT COSTS: ***		0.14	4.07	0.02	1.70	0.09	5.88
WC=1100	100.00	LF EELEF		14	407	2	170	9	588
16120 1700 600 VOLT FEEDER WIRE, SINGLE STR COPPER CONDUCTOR, PULLED IN COND									
CD=4 EL 1711 NO 2/0 TYPE THWN	***	UNIT COSTS: ***		19.62	591.69	2.65	825.93	41.30	1461.57
WC=1100	0.30	MLF EELEF		6	178	1	248	12	438
16900 CONTROLS AND INSTRUMENTATION									
16950 2000 CHILLER CONTROLS									
CD=3 EL 2001 CHILLER CONTROL PACKAGE	***	UNIT COSTS: ***		50.00	1650.50	0.00	12000.00	600.00	14250.50
WC=1100	1.00	EA EELEA		50	1,651	0	12,000	600	14,251
TOTAL DIVISION 16 ELECTRICAL				69	2,235	3	12,418	621	15,277
TOTAL FACILITY AA. ELECTRICAL				69	2,235	3	12,418	621	15,277

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6944-3
3-209

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 14:30:14

DETAILED ESTIMATE

DETAIL PAGE 2

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
15050 BASIC MATERIALS AND METHODS									
15061 2300 BLACK PIPE (ASTM A-53) AND FITTINGS									
CD=4 HV 2302 3 IN (80MM) P.E. SCH 40	*** UNIT COSTS: ***			0.17	4.59	0.18	3.83	0.19	8.79
WC=0800	100.00 LF MSPFE			17	459	18	383	19	879
CD=4 HV 2305 6 IN (150MM) P.E. SCH 40	*** UNIT COSTS: ***			0.32	8.89	0.34	8.44	0.42	18.09
WC=0800	100.00 LF MSPFE			32	889	34	844	42	1,809
15061 2320 90 DEGREE LR WELD ELL STD. WT.									
CD=4 HV 2323 6 IN	*** UNIT COSTS: ***			5.78	159.21	6.08	27.20	1.36	193.85
WC=0800	16.00 EA MSPFE			92	2,547	97	435	22	3,102
15061 2340 TEE FULL SIZE BUTT WELD STD WT.									
CD=4 HV 2343 6 IN	*** UNIT COSTS: ***			8.70	239.51	9.14	37.50	1.88	288.02
WC=0800	4.00 EA MSPFE			35	958	37	150	8	1,152
15100 9100 TRIPLE DUTY VALVES									
CD=3 HV 9101 6" TRIPLE DUTY VALVES	*** UNIT COSTS: ***			3.33	99.77	1.34	1015.00	50.75	1166.86
WC=0900	2.00 EA MSPFA			7	200	3	2,030	102	2,334
15180 INSULATION									
15182 1000 FIBERGLASS PIPE COVERING WITH FIRE RETARDANT									
JACKETS NOTE - COST DOES NOT INCLUDE FITTINGS - FOR FITTINGS ADD 3 LF									
(.92M) FOR EACH FITTING PLUS 4 LF (1.2M) FOR EACH FLANGED JOINT									
CD=4 HV 1011 6 IN DIA. PIPE, 1-1/2 IN THK	*** UNIT COSTS: ***			0.11	3.30	0.04	3.17	0.16	6.67
WC=0800	100.00 LF AASBC			11	330	4	317	16	667
15650 REFRIGERATION									
15670 3000 NATURAL GAS ENGINE DRIVEN CHILLERS									
CD=3 HV 3005 380 TON NAT GAS ENGINE INCLUDING	*** UNIT COSTS: ***			258	7078.85	514.85	186200.00	9310	203103.69
WC=0900 EXISTING CHILLER DEMOLITION	1.00 EA MSPPO			258	7,079	515	186,200	9,310	203,104
15670 5000 PUMPS									
CD=3 HV 5001 10 HP CENTRIFUGAL VERTICAL SPLIT	*** UNIT COSTS: ***			10.00	299.30	4.03	3000.00	150.00	3453.33
WC=0900 CASE PUMP	2.00 EA MSPFA			20	599	8	6,000	300	6,907
TOTAL DIVISION 15 MECHANICAL				472	13,060	715	196,359	9,818	219,952
TOTAL FACILITY BA. MECHANICAL				472	13,060	715	196,359	9,818	219,952

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6944-3
3-210

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3
1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 14:30:14

TAILED ESTIMATE

DETAIL PAGE 3

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT \$
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE	541			15,295		717	208,777	10,439	235,229
TOTAL BASE BID	541			15,295		717	208,777	10,439	235,229
TOTAL ADDITIVE	0			0		0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY	541			15,295		717	208,777	10,439	235,229

* * * END OF DETAIL REPORT * * *

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

TIME 14:30:14

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-2: CHILLER REPLACEMENTS

SCOPE OF WORK: EVALUATE 4 DIFFERENT REPLACEMENT OPTIONS FOR EXISTING
ABSORPTION CHILLERS IN SELECTED FACILITIES.

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

TIME 14:30:14

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER PCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	15,277	10.0% 1,528	0.0% 0	7.5% 1,260	2.5% 452	0.0% 0	18,516	18516.22
BA	MECHANICAL	1.00 EA	219,952	10.0% 21,995	0.0% 0	7.5% 18,146	2.5% 6,502	0.0% 0	266,596	266595.68
BID ITEM TOTAL		1.00 EA	235,229	23,523	0	19,406	6,954	0	285,112	285111.90
TOTAL BASE BID			235,229	23,523	0	19,406	6,954	0	285,112	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			235,229	23,523	0	19,406	6,954	0	285,112	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6944-3
 3-213

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

TIME 14:30:14

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID BID ITEM	QUANTITY UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
1. BUILDING TO THE 5 FOOT LINE	1.00 EA	285,112		285,112	285111.90
TOTAL CURRENT CONTRACT COST		285,112	0	285,112	
Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%	0	0	0	
ESCALATED CONTRACT COST		285,112	0	285,112	
Government-Furnished Property		0		0	
SUBTOTAL		285,112	0	285,112	
Contingencies	7.0%	19,958	0	19,958	
SUBTOTAL		305,070	0	305,070	
SIOH (S&A)	5.5%	16,779	0	16,779	
CURRENT WORKING ESTIMATE		321,849	0	321,849	

Estimated Construction Time 365 Days

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

TIME 14:30:14

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT W/TX	** TOTAL DIRECT * AMOUNT PCT	* SUBCON * W/OH&P	SUBTOTAL
AA	GENERAL/PRIME		1.00	EA	541	15,295	717	219,216	235,229 100.0%	0	235,229
	TOTAL DIRECT				541	15,295	717	219,216	235,229 100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6944-3
3-215

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

TIME 14:30:1

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 1

ID	CONTRACTOR	PH	SUBTOTAL	*** OVERHEAD *** AMOUNT	PCT	HOF%	**** PROFIT **** AMOUNT	PCT	BOND% OTHER%	***** TOTAL CONTRACT ***** AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		235,229	23,523	10.0%	0.0	19,406	7.5%	2.5% 0.0%	285,112	100.0%	285111.91
	TOTAL OVERHEAD & PROFIT			23,523	10.0%		19,406	7.5%				

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6944-3
3-216

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

TIME 14:30:1

CSI DIVISION SUMMARY

SUMMARY PAGE

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	472	13,060	715	196,359	9,818	219,952
16 ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	208,777	10,439	235,229

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

TIME 14:30:14

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
08 PLUMBING	187	5,183	189	2,129	106	7,608
09 HEATING, VENTILATION & AIR CONDIT	285	7,877	526	194,230	9,712	212,344
11 INTERIOR ELECTRICAL	69	2,235	3	12,418	621	15,277
TOTAL DIRECT	541	15,295	717	208,777	10,439	235,229

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 6944-3
3-218

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

TIME 14:30:1-

EQUIPMENT SUMMARY

SUMMARY PAGE 3

EQUIP DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	**** TOTAL HOURS	**** COS
ECR25 CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	12	30
EMI20 SMALL TOOLS								1.40	1.40	143	20
EWEL0 WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	132	21
TOTAL PROJECT EQUIPMENT HOURS										288	71

Wed 01 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: CHILLER REPLACEMENT BLDG 6944 OPTION 3

TIME 14:30:14

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT	DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LASBW	ASBESTOS WORKER	20.45	0.0%	24.0%	5.91	0.00	31.27	24.86	11	330
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	69	2,235
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	62	1,505
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	12	403
LSPFI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	387	10,821
TOTAL PROJECT MANHOURS									541	15,295

* * * END OF SUMMARY REPORT * * *

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 09:11:15

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93

Current UPB/CSI ID: ORL290

M - C A C E S E D I T I O N
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040
3-221

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

TIME 09:11:15

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DETAILED ESTIMATE DETAIL PAGE

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Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: ABSORPTION CHILLERS - COOLING TOWERS
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 09:11:15

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL		QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT \$
16900 CONTROLS AND INSTRUMENTATION										
16920 1000 VARIABLE SPEED DRIVES										
CD=3 EL 1005	140 TON VSD COOLING TOWER FAN	***	UNIT COSTS: ***	20.00	660.20	2.58	6000.00	300.00	6962.78	
WC=1100	AND CONTROLS	1.00	EA EELEB	20	660	3	6,000	300	6,963	
CD=3 EL 1006	180 TON VSD COOLING TOWER FAN	***	UNIT COSTS: ***	20.00	660.20	2.58	8000.00	400.00	9062.78	
WC=1100	AND CONTROLS	1.00	EA EELEB	20	660	3	8,000	400	9,063	
CD=3 EL 1007	210 TON VSD COOLING TOWER FAN	***	UNIT COSTS: ***	20.00	660.20	2.58	9000.00	450.00	10112.78	
WC=1100	AND CONTROLS	2.00	EA EELEB	40	1,320	5	18,000	900	20,226	
CD=3 EL 1008	305 TON VSD COOLING TOWER FAN	***	UNIT COSTS: ***	20.00	660.20	2.58	12000.00	600.00	13252.78	
WC=1100	AND CONTROLS	1.00	EA EELEB	20	660	3	12,000	600	13,263	
CD=3 EL 1010	320 TON VSD COOLING TOWER FAN	***	UNIT COSTS: ***	20.00	660.20	2.58	12000.00	600.00	13262.78	
WC=1100	AND CONTROLS	5.00	EA EELEB	100	3,301	13	60,000	3,000	66,314	
CD=3 EL 1011	380 TON VSD COOLING TOWER FAN	***	UNIT COSTS: ***	20.00	660.20	2.58	14000.00	700.00	15362.78	
WC=1100	AND CONTROLS	1.00	EA EELEB	20	660	3	14,000	700	15,363	
CD=3 EL 1012	570 TON VSD COOLING TOWER FAN	***	UNIT COSTS: ***	20.00	660.20	2.58	17000.00	850.00	18512.78	
WC=1100	AND CONTROLS	1.00	EA EELEB	20	660	3	17,000	850	18,513	
TOTAL DIVISION 16 ELECTRICAL						240	7,922	31	135,000	6,750 149,703
TOTAL FACILITY AA. ELECTRICAL						240	7,922	31	135,000	6,750 149,703

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040

3-223

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-4: ABSORPTION CHILLERS - COOLING TOWERS
 1. BUILDING TO THE 5 FOOT LINE / BA. MECHANICAL

TIME 09:11:15

DETAILED ESTIMATE

DETAIL PAGE 2

BASE BID

DIVISION 15 MECHANICAL	QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
15650 REFRIGERATION									
15680 3000 PROPELLER TYPE COOLING TOWER WITH FAN MOTOR									
CD=3 HV 3001 140 TONS	*** UNIT COSTS: ***			134	3681.00	267.72	12600.00	630.00	17178.72
WC=0900	1.00 EA MSPFO			134	3,681	268	12,600	630	17,179
CD=3 HV 3002 180 TONS	*** UNIT COSTS: ***			134	3681.00	267.72	16200.00	810.00	20958.72
WC=0900	1.00 EA MSPFO			134	3,681	268	16,200	810	20,959
CD=3 HV 3003 210 TONS	*** UNIT COSTS: ***			134	3681.00	267.72	18900.00	945.00	23793.72
WC=0900	2.00 EA MSPFO			269	7,362	535	37,800	1,890	47,587
CD=3 HV 3004 305 TONS	*** UNIT COSTS: ***			134	3681.00	267.72	27450.00	1373	32771.22
WC=0900	1.00 EA MSPFO			134	3,681	268	27,450	1,373	32,771
CD=3 HV 3005 320 TONS	*** UNIT COSTS: ***			134	3681.00	267.72	28800.00	1440	34188.72
WC=0900	5.00 EA MSPFO			672	18,405	1,339	144,000	7,200	170,944
CD=3 HV 3006 380 TONS	*** UNIT COSTS: ***			134	3681.00	267.72	34200.00	1710	39858.72
WC=0900	1.00 EA MSPFO			134	3,681	268	34,200	1,710	39,859
CD=3 HV 3007 570 TONS	*** UNIT COSTS: ***			168	4601.25	334.65	51300.00	2565	58800.90
WC=0900	1.00 EA MSPFO			168	4,601	335	51,300	2,565	58,801
TOTAL DIVISION 15 MECHANICAL				1646	45,092	3,280	323,550	16,178	388,099
TOTAL FACILITY BA. MECHANICAL				1646	45,092	3,280	323,550	16,178	388,099
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE				1886	53,015	3,311	458,550	22,928	537,803
TOTAL BASE BID				1886	53,015	3,311	458,550	22,928	537,803
TOTAL ADDITIVE				0	0	0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY				1886	53,015	3,311	458,550	22,928	537,803

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040
3-224

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

TIME 09:11:15

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-4: ABSORPTION CHILLER REPLACEMENT

SCOPE OF WORK: REPLACE EXISTING COOLING TOWERS ALONG WITH CHILLERS TO
INCREASE ENERGY EFFICIENCY.

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040
3-225

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

TIME 09:11:15

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	149,703	10.0% 14,970	0.0% 0	7.5% 12,351	2.5% 4,426	0.0% 0	181,450	181449.83
BA	MECHANICAL	1.00 EA	388,099	10.0% 38,810	0.0% 0	7.5% 32,018	2.5% 11,473	0.0% 0	470,401	470400.63
BID ITEM TOTAL		1.00 EA	537,803	53,780	0	44,369	15,899	0	651,850	651850.46
TOTAL BASE BID			537,803	53,780	0	44,369	15,899	0	651,850	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			537,803	53,780	0	44,369	15,899	0	651,850	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040
3-226

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

TIME 09:11:15

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
	1. BUILDING TO THE 5 FOOT LINE	1.00	EA	651,851		651,851	651850.50
	TOTAL CURRENT CONTRACT COST			651,851	0	651,851	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			651,851	0	651,851	
	Government-Furnished Property			0		0	
	SUBTOTAL			651,851	0	651,851	
	Contingencies	10.0%		65,185	0	65,185	
	SUBTOTAL			717,036	0	717,036	
	SIOH (S&A)	5.5%		39,437	0	39,437	
	CURRENT WORKING ESTIMATE			756,473	0	756,473	

Estimated Construction Time 365 Days

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040
3-227

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

TIME 09:11:15

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT W/TX	AMOUNT	PCT	W/OH&P	SUBTOTAL
AA	GENERAL/PRIME		1.00	EA	1886	53,015	3,311	481,478	537,803	100.0%	0	537,803
	TOTAL DIRECT				1886	53,015	3,311	481,478	537,803	100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040

3-228

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

TIME 09:11:15

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PM	SUBTOTAL	AMOUNT	PCT	HOFC%	AMOUNT	PCT	BOND%	OTHR%	AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		537,803	53,780	10.0%	0.0	44,369	7.5%	2.5%	0.0%	651,850	100.0%	651850.46
	TOTAL OVERHEAD & PROFIT			53,780	10.0%		44,369	7.5%					

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040
3-229

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

TIME 09:11:15

CSI DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
15 MECHANICAL	1646	45,092	3,280	323,550	16,178	388,099
16 ELECTRICAL	240	7,922	31	135,000	6,750	149,703
TOTAL DIRECT	1886	53,015	3,311	458,550	22,928	537,803

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040

3-230

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

TIME 09:11:15

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
09 HEATING, VENTILATION & AIR CONDIT	1646	45,092	3,280	323,550	16,178	388,099
11 INTERIOR ELECTRICAL	240	7,922	31	135,000	6,750	149,703
TOTAL DIRECT	1886	53,015	3,311	458,550	22,928	537,803

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040

3-231

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

TIME 09:11:15

EQUIPMENT SUMMARY

SUMMARY PAGE 8

----- *** BOOK VALUE ***		ADJ FACTOR	ADJUSTD	BOOK OP	-- HRLY	--- UPB	**** TOTAL ****							
EQUIP	DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	RATE	RATE	HOURS	COST		
ECR25	CRANE, 22 TON, HYDRAULIC, SP (34								24.63	24.63	78	1,931		
EMI20	SMALL TOOLS								1.40	1.40	532	744		
EWEL0	WELDING MACHINE, ELEC, 300 AMP (1.62	1.62	392	635		
											-----	-----		
TOTAL PROJECT EQUIPMENT HOURS													1002	3,310

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040
3-232

Thu 30 Sep 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-4: ABSORPTION CHILLERS - COOLING TOWERS

TIME 09:11:15

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT	DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LELEC	ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	240	7,922
LLABR	LABORER/HELPER	17.25	0.0%	24.0%	3.07	0.00	24.46	18.52	392	9,588
LOEME	EQ OPER, MEDIUM	21.40	0.0%	24.0%	6.20	0.00	32.74	21.87	78	2,567
LSPFI	STEAM/PIPEFITTERS	20.95	0.0%	24.0%	3.85	0.00	29.83	26.12	1176	32,937
									1886	53,015
TOTAL PROJECT MANHOURS										

* * * END OF SUMMARY REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: CTE040
3-233

WAUKESHA

Lean Combustion Gas Engine

3521 GL
554 to 773 BHP

DESIGN FEATURES

ENGINE

Breather - Extractor breather system.

Crankcase - Alloy cast iron, integral with cylinder frame. Seven large diameter main bearings.

Crankshaft - Drop forged, alloy steel, with hardened journals, dynamically balanced and fully counterweighted. Viscous vibration damper.

Cylinder heads - Six, interchangeable, valve-in-head type, with stellite faced intake and exhaust valves and seats. Prechamber and fuel control valves.

Connecting rods - Drop forged alloy steel, rifle drilled for piston pin lubrication and undercrown cooling.

Cylinders - Replaceable wet cylinder liners of centrifugally cast alloy iron.

Flywheel housing - SAE No.00.

Pistons - Aluminum alloy, oil cooled, with full floating piston pin.

STANDARD EQUIPMENT

AIR INDUCTION SYSTEM

Air Cleaner - Two stage dry element cleaner with rain shield and service indicator.

Turbocharger - Dry-type with wastegate.

Intercooler - Air-to-water.

CONTROL SYSTEM

Pneumatic controls, including pilot-operated valves for air starting and prelubrication.

Safety Shutdown - Mechanical fuel shutoff for low lube oil pressure, high water temperature, overspeed, high intake manifold temperature. Manual re-set.

EXHAUST SYSTEM

Cast iron, water-cooled manifold. Single vertical 6" (152mm) flange, ANSI 125#, at rear and flexible stainless steel exhaust connection.

FUEL SYSTEM

Natural gas carburetor and gas regulator. Prechamber fuel system and control logic.

Governor - Woodward UG-8 LD lever-controlled hydraulic governor.

IGNITION SYSTEM

Altronic III, high energy, solid state magneto with long duration coils, harness and ignition switch.

INSTRUMENTATION

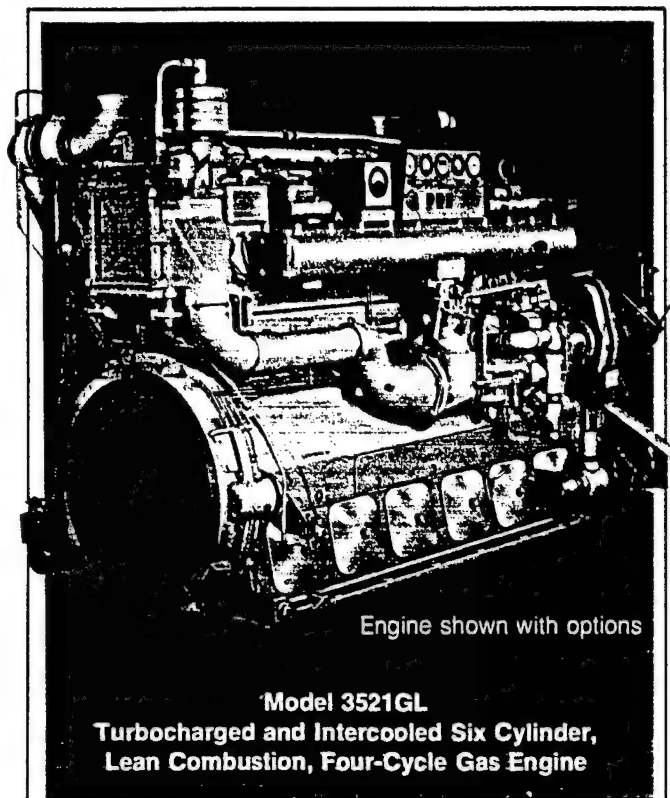
Engine mounted water temperature, oil pressure, oil temperature gauges. Digital electronic tachometer. Intake manifold temperature and intake manifold compound pressure/vacuum gauges. Exhaust thermocouples (7) with switch and jack.

LUBRICATION SYSTEM

Full pressure system with high-capacity gear-type pump, full flow oil filter with strainer and base-type oil pan. Shell-and-tube oil cooler with thermostatic control. Air/gas-motor driven prelubrication pump.

WATER CIRCULATION SYSTEM

Belt-driven jacket water pump, with thermostatically controlled, full-flow bypass cooling circuit. Auxiliary pump and circuit for intercooler and lube oil cooler.



Engine shown with options

Model 3521GL
Turbocharged and Intercooled Six Cylinder,
Lean Combustion, Four-Cycle Gas Engine

SPECIFICATIONS

Cylinders	Inline 6
Piston Displacement	3521 cu. in. (58l)
Bore & Stroke	9.375" X 8.5" (238 X 216 mm)
Compression Ratio.....	10.5:1
Jacket Water System Capacity	48.5 gal. (184l)
Lube Oil System Capacity	66 gal. (250l)
Starting System...	125-150 psi air/gas; 24/32V. electric
Dry Weight	15,000 lb. (6800 kg)
Full Load Exhaust Emissions	
NOx.....	2 g/hph
CO.....	2 g/hph
HC. (non-methane)	1 g/hph

OPTIONAL EQUIPMENT

Controls - Woodward hydraulic or electric governors, pneumatic speed modulator, Waukesha Engomatic • Control Systems.

Cooling System - Radiator, heat exchanger, ebullient or hot water cooling.

Flywheel - Machined to customer specifications.

Power Take-off - Clutch PTO, stub shaft for direct drive.

Starter - Air/gas or electric.

POWER RATINGS*

	85°F (29°C)						INTERCOOLER INLET WATER TEMPERATURE	130°F (54°C)					
	700 rpm	800 rpm	900 rpm	1,000 rpm	1,000 rpm	1,200 rpm		700 rpm	800 rpm	900 rpm	1,000 rpm	1,100 rpm	1,200 rpm
High Speed Turbochargert	307*	464	580	644	709	773	High Speed Turbochargert	288	443	544	615	709	773
Low Speed Turbochargert†	383	516	580	644	—	—	Low Speed Turbochargert†	366	492	544	615	—	—

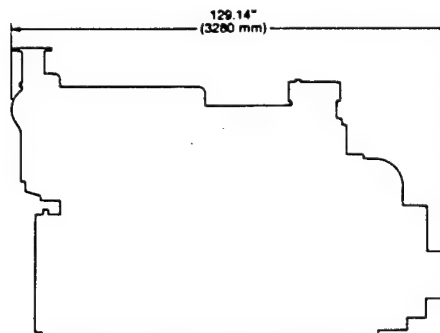
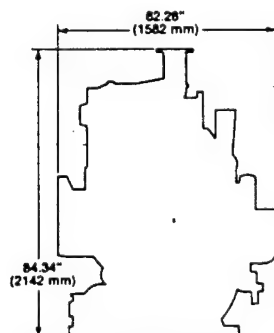
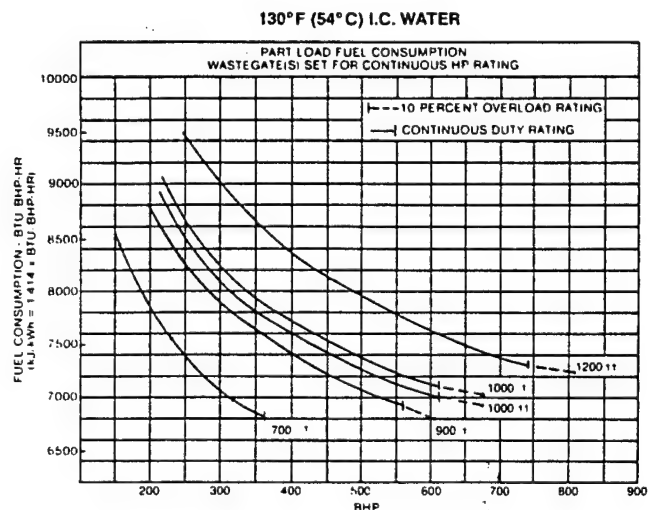
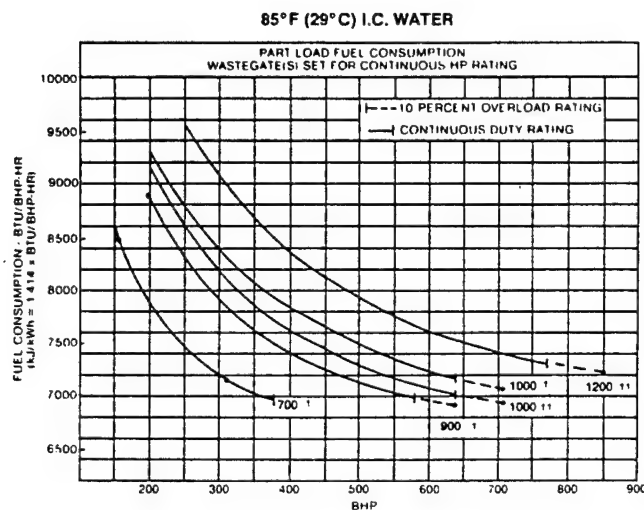
†High speed turbocharger match — 1001-1200 rpm

††Low speed turbocharger match — 700-1000 rpm

***Rating Standard:** All engine data is based on these conditions: barometric pressure—29.38 in (746 mm) mercury; inlet manifold air temperature—85°F (29°C). Altitude—500 ft. (152 m). Correction of ratings may be necessary for some high altitude or high inlet air temperature applications. Check Waukesha Engine Division Technical Data Book for factors.

****Continuous Power Rating:** The highest load and speed which can be applied—24 hours a day, seven days a week—except for normal maintenance. The rating includes operation of the engine at up to 10% overload for two hours in each 24 hour period.

FUEL CONSUMPTION



The manufacturer reserves the right to change or modify without notice, the design, equipment specifications or ratings as herein set forth without incurring any obligation either with respect to engines previously sold, or in the process of construction except where otherwise specifically guaranteed by the manufacturer.

Waukesha Sales Offices Worldwide

Baltimore
(301) 761 5350

Brussels
(32) (2) 6604166

Calgary
(403) 2686666

Caracas
(58) (2) 979 0568

Chicago
(312) 490 1115

Denver
(303) 779 5675

Houston
(713) 893 4170

San Francisco
(415) 283 7713

Singapore
(65) 7377955

Waukesha



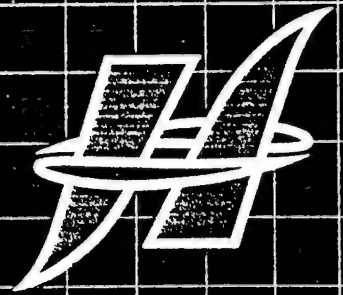
WAUKESHA ENGINE DIVISION
DRESSER INDUSTRIES INC.
WAUKESHA, WISCONSIN 53188

Bulletin 7002B
Litho in U.S.A. 4/87

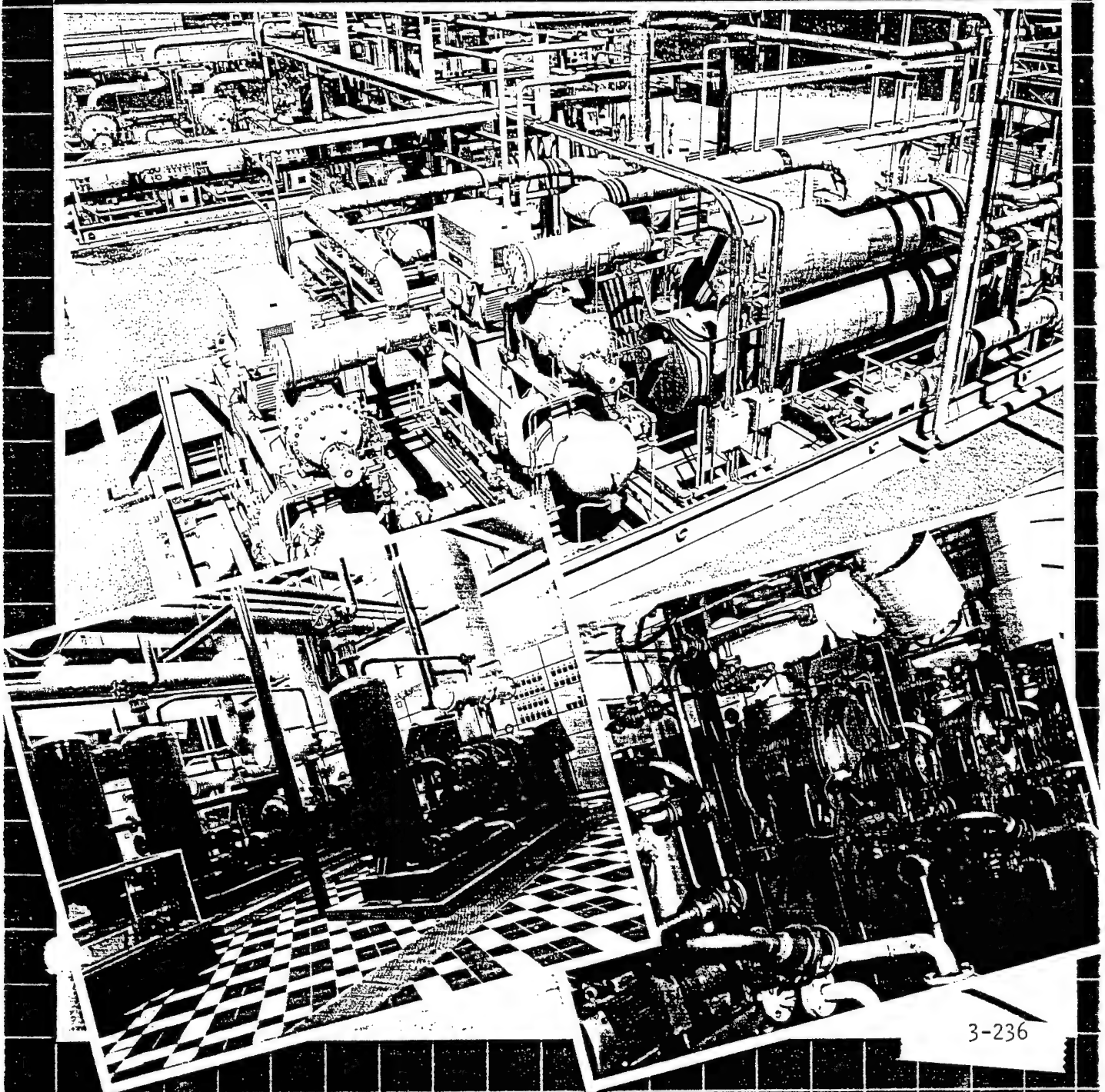
3-235

WED
TECHNICAL
COMMUNICATIONS

HOWDEN COMPRESSORS



GAS AND REFRIGERATION COMPRESSORS



INNOVATIVE ENGINEERING

Howden Compressors were the first company in the world to commercially produce screw compressors and have pioneered many major innovations, including oil injection. This concept was of prime importance in the advance of compressor technology. From the first screw compressor produced in 1938 to today's WRV 510, the largest screw compressor of its type in the world, Howden are at the forefront of compressor technology. The Howden WRV Gas and Refrigeration Screw Compressor is used throughout the world in plants for refrigeration and cold storage; for air conditioning; food freezing and storage including marine applications; mine cooling and ground freezing; heat pumps; oil dewaxing, chemical works and brewery cooling plant. Other applications include gas reliquefaction; fuel gas compression for gas turbines; underground air boosting; carbon dioxide recovery and natural gas gathering; and the compression of Helium, Propane, Butane, Methane, Hydrocarbon mixtures with H_2S , Hydrogen, LPG, Bitumen blowing air; R12, R22, R502 and R114, Propylene and Ammonia.

COMPREHENSIVE RANGE

Howden compressors are manufactured and supplied in a wide range of materials, special versions are available for higher pressure applications, with alternative bearings and for reverse rotation etc.

OPERATION

The compressor consists of two intermeshing asymmetric profile rotors mounted in a suitable casing. The action of the rotors is entirely rotary and there are no valves or other equivalent wearing parts. The operation ensures a continuous pulsation free delivery with no vibration and only light foundations are necessary.

CAPACITY CONTROL

The compressor is fitted with a built-in sliding control valve which controls the capacity of the machine by altering the point on the rotor length at which compression begins. Control down to 10 per cent with an approximately proportional saving in power is obtained. The sliding valve can be operated manually or automatically, by a hydraulic actuator. The oil pressure for the hydraulic actuator is provided from the compressor oil system.

LUBRICATION SYSTEM

A pressure lubrication system is employed incorporating an oil cooler having sufficient capacity to dissipate the heat of compression absorbed by the oil, ensuring that the discharge temperature never exceeds $100^{\circ}C$ ($212^{\circ}F$). Micronic filters are used and arranged for easy element changing. Alternatively liquid refrigerant injection can be used which reduces oil flow and eliminates an oil cooler. Details of the system and the effect on performance are available upon application.

INSTRUMENTATION

Appropriate indicators and protection devices are included in the standard instrument panel.

ADVANTAGES

Compact, rotary, vibration free unit having high capacity and requiring no special foundations. Simple design with minimum of wearing parts ensures extreme reliability and low maintenance costs. Due to the principle of operation and as there are no compressor valves, slugs of liquid can pass through the compressor without damage. Designed for continuous 24 hour per day duty.

SUPERFEED COMPRESSORS

Howden WRV Compressors are supplied with a superfeed connection. This is a development of the screw compressor whereby an additional charge of gas is passed into the compressor over and above that which is drawn in the normal manner. This can increase the compressor refrigeration capacity by up to 60 per cent depending on refrigerant and duty, with a consequent improvement in compressor efficiency.

ELECTRICAL EQUIPMENT

Electrical equipment is offered to meet classifications ranging from standard industrial (indoor and outdoor) through to fully flameproof specifications, suitable for Zone I or II hazardous areas.

TYPICAL PERFORMANCE

AMMONIA

KEY TO GRAPHS

WRV 510/1.65 @ 1,500rpm
B WRV 510/1.65 @ 1,000rpm
C WRV 321/1.93 @ 3,000rpm
WRV 321/1.65 @ 3,000rpm
E WRV 321/1.32 @ 3,000rpm
F WRV 255/2.2 @ 3,000rpm
G WRV 255/1.65 @ 3,000rpm
H WRV 255/1.1 @ 3,000rpm
I WRV 204/1.93 @ 3,000rpm
J WRV 204/1.65 @ 3,000rpm
K WRV 204/1.1 @ 3,000rpm
L WRV 163/1.8 @ 3,000rpm
M WRV 163/1.45 @ 3,000rpm

NOTES:

Refrigeration capacity based on 5.6°C (10°F) superheat at compressor suction and no sub-cooling of condensed liquid.

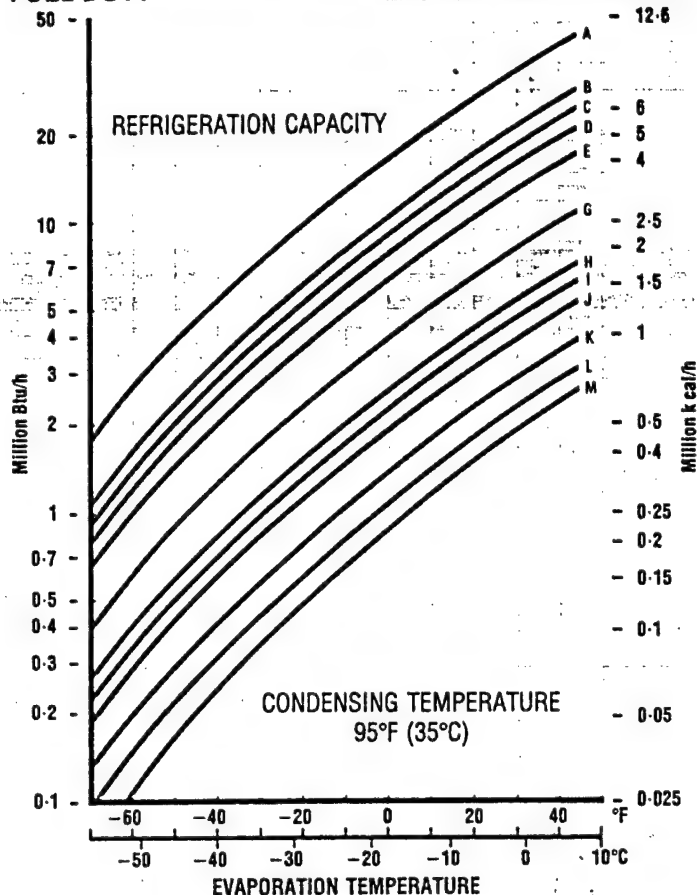
allowance has been made for pressure losses between the evaporator and the compressor suction flange.

Compressors suitable for condensing temperatures up to 135°F (57°C).

In order to obtain the equivalent performance with 60cps electrical supply, i.e. 3,600rpm, multiply value from graph by 1.2.

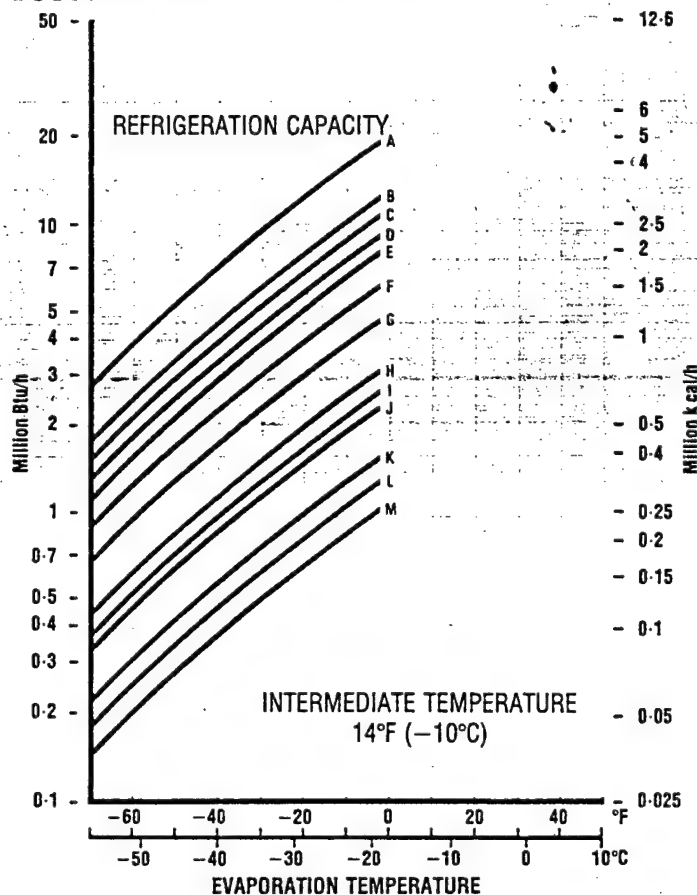
In order to obtain a performance at 3,600rpm and measured in "Tons" of refrigeration the value from the graph in BTU per hour is multiplied by 1.2 and divided by 12,000 which is the same as dividing by 10,000.

FULL DUTY

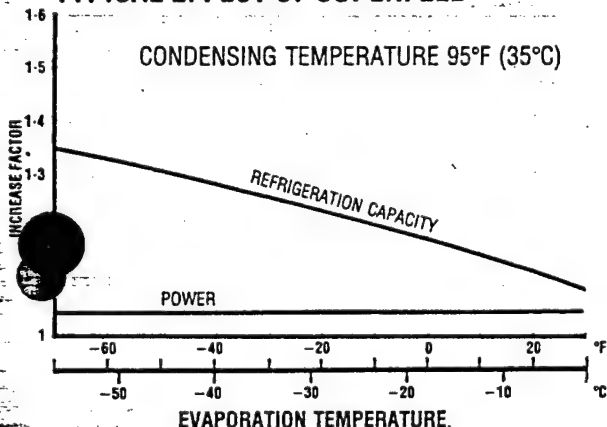


EXCLUDING SUPERFEED

BOOSTER DUTY



TYPICAL EFFECT OF SUPERFEED



TYPICAL PERFORMANCE

R22

KEY TO GRAPHS

- A WRV 510/1.65 @ 1,500rpm
- B WRV 510/1.65 @ 1,000rpm
- C WRV 321/1.93 @ 3,000rpm
- D WRV 321/1.65 @ 3,000rpm
- E WRV 321/1.32 @ 3,000rpm
- F WRV 255/2.2 @ 3,000rpm
- G WRV 255/1.65 @ 3,000rpm
- H WRV 255/1.1 @ 3,000rpm
- I WRV 204/1.93 @ 3,000rpm
- J WRV 204/1.65 @ 3,000rpm
- K WRV 204/1.1 @ 3,000rpm
- L WRV 163/1.8 @ 3,000rpm
- M WRV 163/1.45 @ 3,000rpm

NOTES:

Refrigeration capacity based on 5.6°C (10°F) superheat at compressor suction and no sub-cooling of condensed liquid.

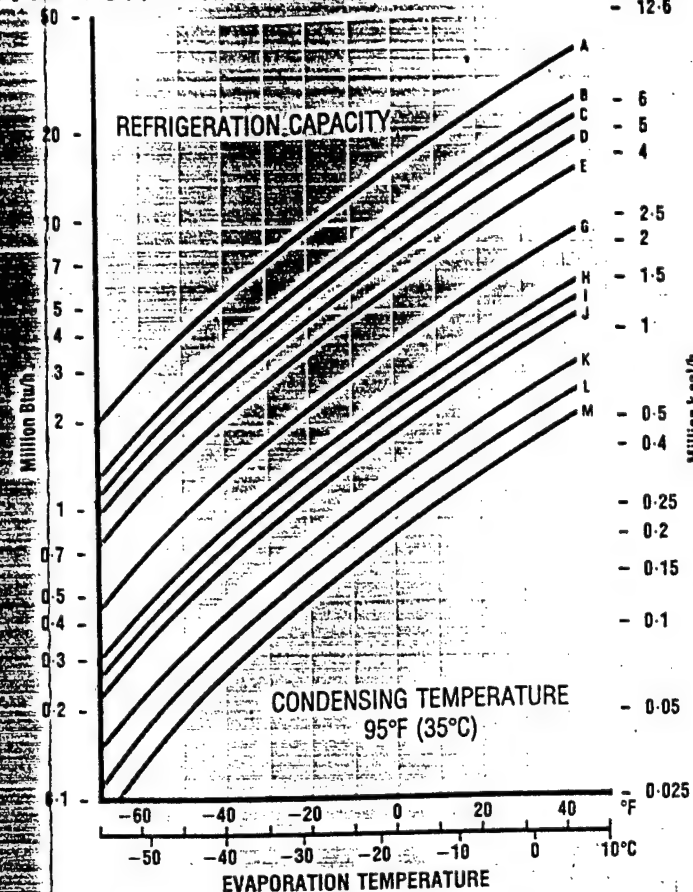
allowance has been made for pressure losses between the evaporator and the compressor suction flange.

Compressors suitable for condensing temperatures up to 135°F (57°C).

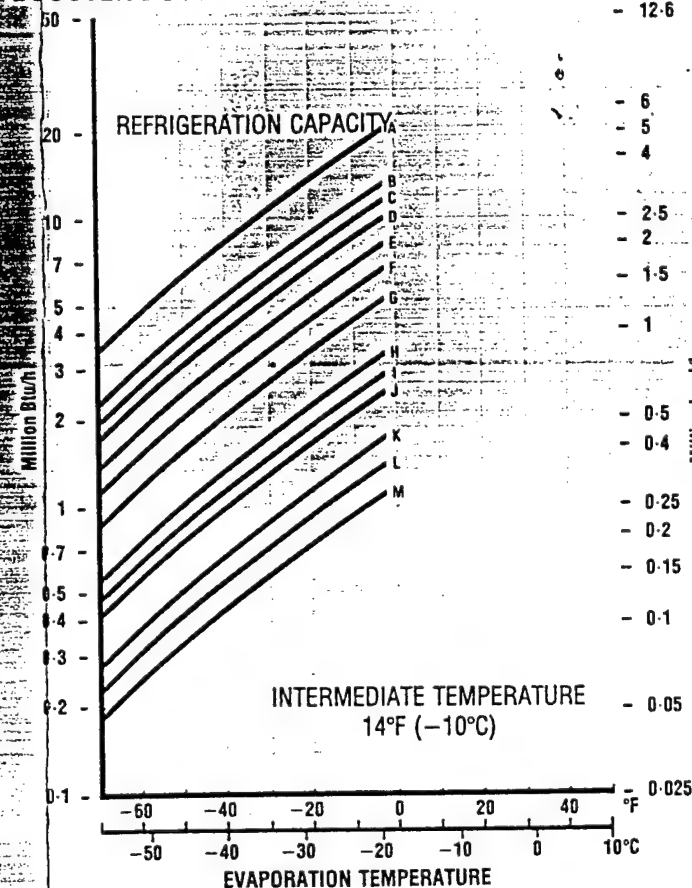
In order to obtain the equivalent performance with 60cps electrical supply, i.e. 3,600rpm, multiply value from graph by 1.2.

In order to obtain a performance at 3,600rpm and measured in "Tons" of refrigeration the value from the graph in BTU per hour is multiplied by 1.2 and divided by 12,000 which is the same as dividing by 10,000.

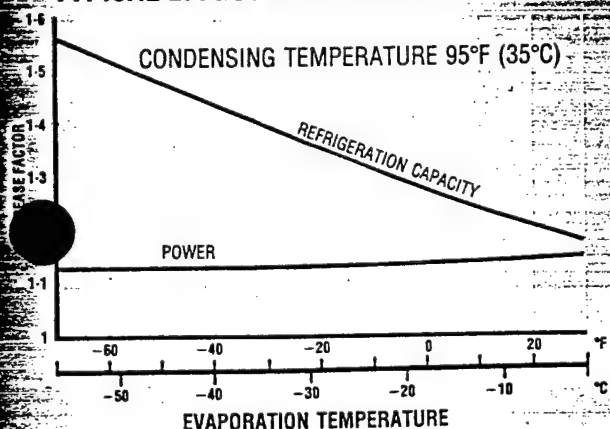
FULL DUTY

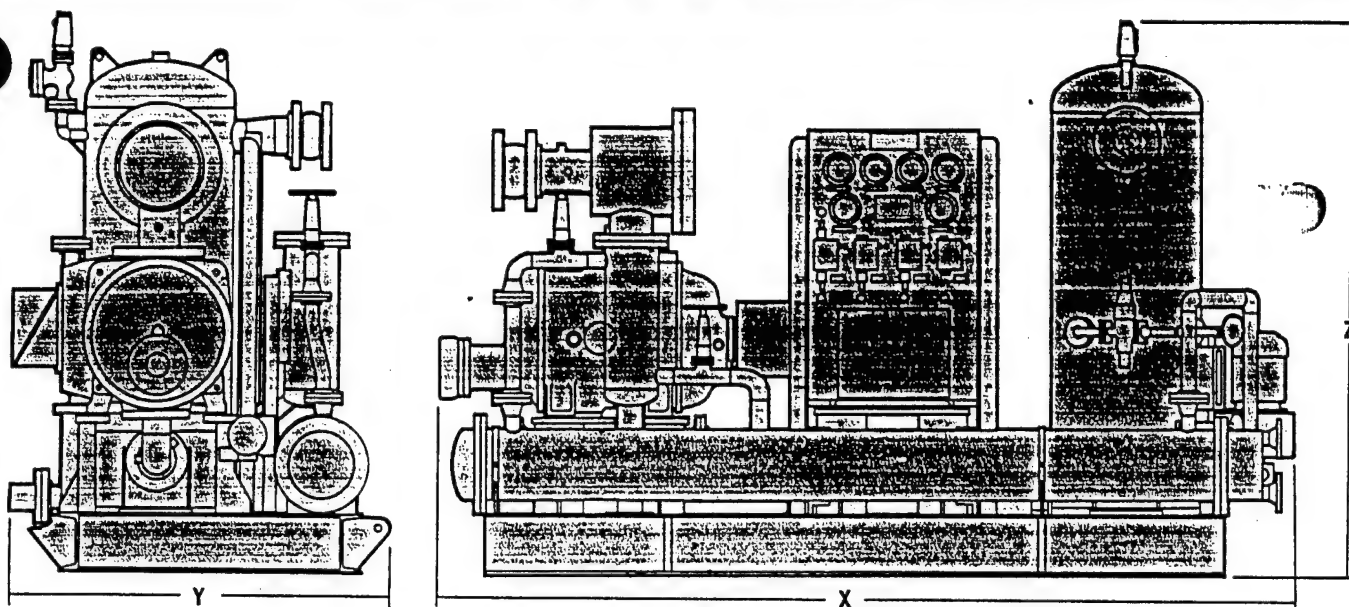


BOOSTER DUTY



TYPICAL EFFECT OF SUPERFEED





Howden engineered compressor sets are available as standard or to customer specification, depending on application, duty and choice of ancillary equipment.

Howden Compressor Specification	Compressor Set Dimensions†						Compressor Set Weight*	
	X Length			Y Width		Z Height		
	mm	ft	in	mm	ft	in	kg	lb
WRV 163/1.45	3100	10	2	1200	3	11	1550	3417
WRV 163/1.8	3200	10	6	1200	3	11	1600	3527
WRV 204/1.1	3300	10	8	1300	4	3	1810	3990
WRV 204/1.65	3500	11	6	1300	4	3	2040	4497
WRV 204/1.93	3500	11	6	1300	4	3	2050	4519
WRV 255/1.1	3600	11	10	1400	4	7	3025	6669
WRV 255/1.65	4100	13	5	1400	4	7	3175	7000
WRV 255/2.2	4100	13	5	1400	4	7	3300	7275
WRV 321/1.32	4300	14	1	1700	5	7	7250	15983
WRV 321/1.65	4500	14	9	1700	5	7	7500	16535
WRV 321/1.93	4700	15	5	1700	5	7	7575	16700
WRV 510/1.65	4750	15	7	3000	9	10	18500	40785

* Weights do not include drive units or cooler.

† Dimensions of engineered sets may vary according to specification of equipment.

These figures are indicative only. Your application and duty, together with choice of ancillary equipment may dictate a different format. Howden compressor sets are engineered to meet all relevant international standards. All pressure vessels are designed to ASME VIII, however other codes may be worked to, if specified.

Howden Compressors Ltd provide the enclosed data as a guide to their product range. All data is subject to revision and modification. Current data must be confirmed at time of ordering.

**HOWDEN
COMPRESSORS
LIMITED**



133 Barfillan Drive, Glasgow G52 1BE
Telephone 041-882 3346 Telex 778711
Fax 041-882 8648

HOWDEN COMPRESSORS

Howden Compressors Incorporated

23 Old Windsor Road
Bloomfield, CT 06002
Telephone (203) 242-7351
Telex 643-226
Fax (203) 242-3782

A Howden Group Company



SECTION 4

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4 PROGRAMMING DOCUMENT - ECIP PROJECT 2

The ECO evaluation consisted of determining appropriate lighting replacements to improve lighting system efficiency while achieving recommended illumination levels. The ECO includes comprehensive lighting replacements.

LIGHTING SYSTEM REPLACEMENTS ECO 5	
EXISTING LIGHTING	REPLACEMENT LIGHTING

T-12 Fluorescent Fixture	T-8 Fluorescent Fixture with reflector
T-12 Lamp	T-8 Lamp
Magnetic Ballast	Electronic Ballast

Incandescent Fixture	Compact Fluorescent Fixture
Incandescent Lamp	Compact Fluorescent Lamp and Ballast
Incandescent Exit Sign	LED (Light Emitting Diode) Exit Sign

Mercury Vapor Fixture	High Pressure Sodium Fixture
Mercury Vapor Ballast	Electronic Ballast
Mercury Vapor Lamp	High Pressure Sodium Lamp

The lighting replacements are for administrative, warehouse, maintenance, and retail facilities and roadway lighting.

This section contains the programming documentation for ECIP Project 2, improvement of indoor/outdoor lighting efficiency. Included are the project development brochures, 1391 forms, life cycle cost analysis, cost estimates for each building, and energy calculations for each building. Catalog cut sheets are included as an appendix to the document (located at the end of this section) to represent the replacement products.

4 PROGRAMMING DOCUMENT - ECIP PROJECT 2

The life cycle analysis, Sections 3A and 3B, refers to non-energy savings or costs present. For this project, Section 3A, Annual Recurring, reflects maintenance savings available by replacing the existing lighting systems. The new fixtures, due to the use of reflectors, have fewer lamps which saves on material and labor replacement. Compact fluorescents are rated for 10,000 hours versus 750 hours for an incandescent lamp which saves labor for replacements. LED exit signs have similar savings.

Section 3B, Non-Recurring Savings/Costs, refers to the replacement of parts of the existing lighting system. Many fluorescent fixtures surveyed were approaching the end of their economic life. On the spreadsheets included for fluorescent fixture replacement for each building, the higher wattage fixture for each type was replaced in this section. Mercury vapor fixtures were also replaced in 3B due to the termination of their manufacturing in the year 2000.

facility

INTERIOR/EXTERIOR LIGHTING REPLACEMENT

Fort Campbell, Kentucky

project coordinator for using service

Arlin Wright

functional requirements summary, PDB-1

4-2

OBJECTIVE:

The objective of this project is to replace existing interior and exterior lighting with higher efficiency fixtures and lamps. The replacement of the existing lighting will reduce energy consumption and life cycle operating costs for the subject facilities in accordance with the Army Energy Resources Management Plan (ERMP) and Executive Order 12759.

functional requirements summary, PDB-1

4-3

[illegible]

4-4

APPENDIX C
DOCUMENTATION CHECKLIST

A. SPECIAL CONSIDERATIONS

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
A-1	Cost estimates for each primary and supporting facility	R	D		1
A-2	Telecommunications system coordination with USACC and authorization for exceptions	NR			
A-3	Coordination with state and local governmental requirements (blind vendors, medical facilities, construction and operating permits, clearinghouse coordination, etc.)	R	A		
A-4	Assignment of airspace	NR			
A-5	Economic analysis of alternatives	R	D		
A-6	Approval for new starts	NR			
A-7	International balance of payments (IBOP) coordination with U.S. European command and NATO—overseas cost estimates and comparables (include rate of exchange used in estimates)	NR			
A-8	Impact on historic places—on site survey by authorized archeologist and coordination with state historic preservation officer and advisory council on historic preservation	NR			
A-9	Exceptions to established criteria	NR			
A-10	Coordination with various staff agencies (Provost Marshall-physical security, etc.)	R			
A-11	Identification of related or support projects (so projects can be coordinated)	R			
A-12	Required completion date	R			
Other Special Considerations (List and number items)					
1. See Appendix A					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*** BY WHOM** (Check and insert appropriate letter)

- A — DFAE
- B — Using Service
- C — Construction Service
- D — Designer
- E — Other (Check Comments Attached and explain)

documentation checklist

4-6

B. SITE DEVELOPMENT

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
B-1	Consultation with the District Office to determine and evaluate flood plain hazards	NR			
B-2	Preparation, submission, and/or approval of new	NR			
(A)	General Site Plan	NR			
(B)	Annotated General Site Plan	NR			
(C)	Sketch Site Plan	NR			
(D)	Facilities Requirements Sketch	R			
B-3	Preparation of	NR			
(A)	Site Survey	NR			
(B)	Subsoil information	NR			
B-4	Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan	NR			
Other Site Development Considerations (List and number items)					
1. See Project Development Brochure, PDB-1/2					

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E — Other (Check Comments Attached and explain)

documentation checklist

4-7

C. ARCHITECTURAL & STRUCTURAL

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
C-1	Reconciliation with troop housing programs and requirements	NR			
C-2	Evaluation of existing facilities (including degree of utilization)	R	D		1
C-3	Approval for removal and relocation of existing useable facilities	NR			
C-4	Evaluation of off-post community facilities	NR			
C-5	Storage and maintenance facilities (including nuclear weapons)	NR			
C-6	Coordination hospitals, medical and dental facilities with Surgeon General	NR			
C-7	Coordination of aviation facilities with FAA	NR			
C-8	Coordination air traffic control and navigational aids with USACC	NR			
C-9	Tabulation of types and numbers of aircraft	NR			
C-10	Evaluation of laboratory, research and development, and technical maintenance facilities	NR			
C-11	Coordination chapels with Chief of Chaplains	NR			
C-12	Review food service facilities by USATSA	NR			
C-13	Automated data processing system or equipment approvals—cost analysis when ADP and/or communication centers not co-located with related facilities	NR			
C-14	Coordination postal facilities with U.S. Postal Service Regional Director	NR			
C-15	Laundry and dry cleaning facilities coordination with ASD(I&L)	NR			
C-16	Tenant facilities coordination with Installation where sited	NR			
C-17	Facilities for or exposed to explosions, toxic chemicals, or ammunition—review by DDESB (See also Item B-4)	NR			
C-18	Analysis of deficiencies	R	D		1
C-19	Consideration of alternatives	R	D		2
C-20	Determination whether occupants will include physically handicapped or disabled persons	NR			
C-21	As-build drawings for alterations or additions	R	C		
C-22	Availability of Standard Design or site adaptable designs	NR			
Other Architectural & Structural (List and number items)					
1. See Supplemental Data Detailed Project Justification Paragraph D3.					
2. See Supplemental Data Detailed Project Justification Paragraph D4.					

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A — DFAE

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E — Other (Check Comments Attached and explain)

documentation checklist

4-8

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
D-1	Fuel considerations and cost comparison analysis	R	D		
D-2	Energy requirements appraisal (ERA)	R	D		1
D-3	Conformance with DOD Energy Reduction requirements	R	D		
D-4	Evaluation of existing and/or proposed utility systems	R	D		
Other Mechanical and Utility Systems (List and number items)					
1. See Special Requirements, Paragraph 3 (SRP-3)					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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C — Construction Service

D — Designer

E — Other (Check Comments Attached and explain)

documentation checklist

4-9

E. ENVIRONMENTAL CONSIDERATIONS

ITEM		Required or Not Required	To Be * Determined	Comment Attached	Document Attached
E-1	Environmental impact assessment	R	D		1
E-2	EIA conclusions require Environmental Impact Statement	NR			
E-3	Determination of health, environmental or related hazards. Assistance to determine existence of any health, environmental or related hazard may be requested from Aberdeen Proving Ground, MD 21010, the Office of the Surgeon General, Attn: DASG-HCH (Army Environmental Hygiene Agency)	NR			
E-4	Air/water pollution permit, coordination with agencies and compliance with standards at Federal, state and local level	NR			
E-5	Corrective measures associated with Environmental Impact Statements or assessment—list separately and evaluate.	NR			
<p>Other environmental considerations (list and number items)</p> <p>1. See Supplemental Data Detailed Project Justification Paragraph D9.</p>					

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- E — Other (Check Comments Attached and explain)

documentation checklist

4-10

APPENDIX D
TECHNICAL DATA CHECKLIST

A. SPECIAL CONSIDERATIONS

ITEM

A-1	Factors of risk, restriction or unusual circumstance expected to increase costs beyond applicable area averages
A-2	Construction phasing requirements
A-3	Functional support equipment (mechanical, electrical, structural, and security) to be built in
A-4	Equipment in place and justification
A-5	Other equipment and furniture (O&MA, OPA) and costs
A-6	Special studies and tests (hazards analyses, compatibility testing, new technology testing, etc.)
A-7	Type of construction (permanent, temporary, semi-permanent)
A-8	Government furnished equipment (quantities, procurement time, availability and special handling and storage requirements). Funds used for procurement.
	Other special considerations (list and number items)

Required or Not Required	To Be Determined	Comment Attached	Document Attached
NR			
R	D		
NR			
NR			
NR			
NR			
NR			
NR			

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- D — Designer
- E — Other (Check Comments Attached and explain)

technical data checklist

4-12

B. SITE DEVELOPMENT

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
B-1	Construction restrictions or guidelines pertaining to site access and preferred construction routes	R	A		
(B)	Airfield clearance, explosive storage, working hours, safety, etc.	NR			
(C)	Facilities and/or functions or adjoining areas (structures, materials, impact)	R	A		
B-2	Real estate actions (acquisition, disposal, lease, right-of-way)	NR			
B-3	Demolition/relocation required (data)				
(A)	Special considerations due to explosives/radioactivity/chemical contamination/asbestos emissions/toxic gases	R	A	1	
(B)	Restrictions on disposal of demolished/relocated material including hazardous waste	NR			
B-4	Pavement types and requirements (including traffic surveys and MTMC coordination)	NR			
B-5	Landscape considerations				
(A)	Protection of existing vegetation	R	A		
(B)	Stockpile topsoil	NR			
Other Site Development (List and number items)					
1. There is a possibility that the existing lighting may contain PCB's in the ballasts.					

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***BY WHOM** (Check and insert appropriate letter)

A — DFAE

B — Using Service

C — Construction Service

D — Designer

E — Other (Check Comments Attached and explain)

technical data checklist

4-13

C. ARCHITECTURAL & STRUCTURAL

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
C-1	Vibration-producing equipment requiring isolation	R	D		
C-2	Seismic zone and other design load criteria (typhoon, hurricane, earthquake loads, high or low loss potential)	NR			
C-3	Protective shelter evaluation and resistant design criteria (conventional/nuclear blast and radiation, chemical/biological)	NR			
C-4	Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, permafrost areas, soil bearing)	NR			
C-5	Designation and strength of units to be accommodated	NR			
C-6	Requirements and data for special design projects	NR			
C-7	Unusual floor and roof loads (safes, equipment)	NR			
C-8	Security features (arms rooms, vaults, interior secure areas)	NR			
	Other Architectural & Structural (List and number items)				

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

***BY WHOM** (Check and insert appropriate letter)

- A — DFAE
- B — Using Service
- C — Construction Service
- D — Designer
- E — Other (Check Comments Attached and explain)

technical data checklist

4-14

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

ITEM		Required or Not Required	* To Be Determined	Comment Attached	Document Attached
D-1	Special mechanical requirements or considerations (elevator, crane, hoist, etc.)	NR			
D-2	Special peak usage periods and peak leveling techniques	NR			
D-3	Maintenance considerations (accessibility of equipment, compatibility with existing equipment)	R	D		
D-4	Plumbing—availability, general system type and characteristics (proposed and/or existing, incl. compressed air and gas)	R	D		
D-5	Heating—availability, general system type and characteristics (proposed and/or existing)	NR			
D-6	Ventilating, air condition/refrigeration—availability, general system type and characteristics (proposed and/or existing)	R	D		
D-7	Electrical—availability, general system type and characteristics incl. airfield lighting, communication, etc. (proposed and/or existing)	NR			
D-8	Water supply/waste treatment—availability, general system type and characteristics (proposed and/or existing)	NR			
D-9	Energy requirements/fuel conversion (sources, availability, loads, types of fuel, etc.)	R	D		
D-10	Solar energy evaluation	NR			
Other Mechanical & Utility Systems (List and number items)					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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- B — Using Service
- C — Construction Service
- D — Designer
- E — Other (Check Comments Attached and explain)

technical data checklist

4-15

E. ENVIRONMENTAL CONSIDERATIONS

ITEM		Required or Not Required	To Be Determined	Comment Attached	Document Attached
E-1	Waste water treatment, air quality, and solid waste disposal criteria	NR			
	Other Environmental Considerations (List and number items)				

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

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- D — Designer
- E — Other (Check Comments Attached and explain)

technical data checklist

4-16

F. FIRE PROTECTION

ITEM

Required or Not Required	To Be • Determined	Comment Attached	Document Attached
NR			

F-1 Special fire protection systems or features (detection and suppression equipment, hazards, etc.)
Other Fire Protection Considerations (List and number items)

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

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♦ BY WHOM (Check and insert appropriate letter)

- A — DFAE
- B — Using Service
- C — Construction Service
- D — Designer
- E — Other (Check Comments Attached and explain)

technical data checklist

4-17

1. COMPONENT ARMY	FY 19 <u>94</u> MILITARY CONSTRUCTION PROJECT DATA			2. DATE 06 October 93	
3. INSTALLATION AND LOCATION Fort Campbell, Kentucky		4. PROJECT TITLE INTERIOR/EXTERIOR LIGHTING REPLACEMENT			
5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER ECIP #2	8. PROJECT COST (\$000) \$1,050		
9. COST ESTIMATES					
ITEM		U/M	QUANTITY	UNIT COST	COST (\$000)
Primary Facility					
Interior and Exterior Light Fixtures		Lot	1	900,000	900
Subtotal					900
Contingency (10%)					100
Total Contract Cost					1,000
Supervision, Inspection and Overhead (5.0%)					50
Total Request					1,050
<p>10. DESCRIPTION OF PROPOSED CONSTRUCTION</p> <p>The existing interior lighting is a combination of standard efficiency fluorescent fixtures, incandescents, and incandescent exit signs. The existing exterior lighting is a combination of 175W and 400W mercury vapor and 100W high pressure sodium fixtures. The proposed project will replace the interior fluorescent fixtures with T-8's, incandescents with compact fluorescents, and exit signs with LED's. The implementation of this project will save 5725 MBtu/Yr of electrical energy. The first year savings is \$142,057 and the Savings to Investment Ratio (SIR) is 1.48.</p> <p>11. REQUIREMENT</p> <p>Project: The proposed interior/exterior lighting project replaces thirty-eight (38) buildings and four (4) exterior locations lighting with energy efficient lighting.</p> <p>Requirement: The project is required to reduce the energy consumption of lighting and to comply with the Army Energy Resources Management Plan (ERMP) and Executive Order 12759. The proposed project will reduce annual energy consumption by 5725 MBTU/YR and annual energy cost by \$142,057</p> <p>Current Situation: The existing lighting in building numbers 38, 89, 95, 2745, 3202, 3204, 3206, 3207, 3209, 3307, 3308, 5207, 5212, 5661, 5702, 5740, 6087, 6088, 6254, 6302, 6304, 6306, 6308, 6390, 6708, 6713, 6714, 6715, 6717, 6720, 6723, 6729, 7510, 7514, 7541, 7543, 7562, 7574 and exterior areas at Pierce Village, LaPointe Village, Hammond Heights, and Lee Village is inefficient fluorescent, incandescent and mercury vapor.</p>					

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5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER ECIP #2	8. PROJECT COST (\$000) \$1,074		
9. COST ESTIMATES					
ITEM		U/M	QUANTITY	UNIT COST	COST (\$000)
Primary Facility					
Interior and Exterior Light Fixtures		Lot	1	929,534	929
Subtotal					929
Contingency (10%)					93
Total Contract Cost					1,022
Supervision, Inspection and Overhead (5.0%)					52
Total Request					1,074
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<p>Impact if not provided: If the proposed project is not funded, a reduction of 5725 MBtu/YR cannot be achieved, and excessive amounts of energy will continue to be used. There will be no contribution to energy reduction goals established for United States Army facilities by Army Headquarters.</p> <p style="text-align: center;">_____ Colonel, USA Commanding</p> <table> <tr> <td>ESTIMATED CONSTRUCTION START:</td> <td>October 1994</td> <td>INDEX:</td> </tr> <tr> <td>ESTIMATED MIDPOINT OF CONSTRUCTION:</td> <td>April 1995</td> <td>INDEX:</td> </tr> <tr> <td>ESTIMATED CONSTRUCTION COMPLETION:</td> <td>November 1995</td> <td>INDEX:</td> </tr> </table> <p style="text-align: center;">DETAILED JUSTIFICATIONS</p> <p>D1. GENERAL</p> <p>The proposed project encompasses the replacement of lighting in thirty-eight (38) buildings and four (4) family housing areas. The project will decrease the energy consumption of the lighting system without reducing light levels except where necessary.</p> <p>D2. ACCOMMODATIONS NOW IN USE:</p> <p>The existing lighting systems are comprised of standard efficiency fluorescent, incandescent, and mercury vapor fixtures.</p> <p>D3. ANALYSIS OF DEFICIENCY:</p> <p>Currently, thirty-eight (38) buildings and four (4) family housing areas are using standard or low efficiency fixtures for lighting. The purpose of this project is to replace the existing lighting with new light fixtures which are much more efficient. The current deficiency results in large amounts of energy usage to maintain adequate lighting.</p>			ESTIMATED CONSTRUCTION START:	October 1994	INDEX:	ESTIMATED MIDPOINT OF CONSTRUCTION:	April 1995	INDEX:	ESTIMATED CONSTRUCTION COMPLETION:	November 1995	INDEX:
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<p>D4. CONSIDERATION OF ALTERNATIVES:</p> <p>The only alternatives to proposed project are to install lower efficiency light fixtures. The disadvantages of using lower efficiency light fixtures is that less energy savings can be realized without significantly reducing the construction cost. If a less efficient light fixture is selected, the project would have a lower SIR.</p> <p>D5. CRITERIA FOR PROPOSED PROJECT:</p> <p>The proposed project will conform with all applicable federal and United States Army Regulations.</p> <p>D6. PROGRAM FOR RELATED EQUIPMENT:</p> <p>No equipment funded from appropriations other than MCA are required.</p> <p>D7. DISPOSAL OF PRESENT ASSETS:</p> <p>Light fixtures in thirty-eight (38) buildings and four (4) family housing areas will be disposed.</p> <p>D8. SURVIVAL FACILITIES:</p> <p>The proposed project is not suitable for inclusion of protective shelters.</p> <p>D9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES:</p> <p>The proposed project has been analyzed and will not adversely impact the environment. Energy savings resulting from the project will conserve natural resources.</p> <p>D10. EVALUATION OF FLOOD HAZARDS AND ENCROACHMENT ON WETLANDS:</p> <p>It has been determined that these facilities are not located in a flood plain and they do not encroach on wetlands.</p> <p>D11. ECONOMIC JUSTIFICATION:</p> <p>The proposed project qualifies under ECIP Guidelines in AR-415-15. SIR for the project is 1.48 with a simple payback of 7.56 years. See Economic Analysis, SRP-1</p>		

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<p>D12. UTILITY AND COMMUNICATION SUPPORT:</p> <p>A. No related utility support projects are programmed. Adequate utilities are available to support the project.</p> <p>B. No telecommunication support is required.</p> <p>D13. PROTECTION OF HISTORIC PLACES AND ARCHEOLOGICAL SITES:</p> <p>The project involves the replacement of light fixtures located in existing buildings and family housing areas. Review procedures have been implemented for this project in accordance with 36 CFT 800. The review has established that there will be no effect.</p> <p>D14. PROJECT DEVELOPMENT BROCHURE (PART 1):</p> <p>A Project Development Brochure was prepared on 06 October 93 and is attached as a part of the programming documentation.</p> <p>D15. ENERGY REQUIREMENTS:</p> <p>The proposed project will reduce present energy consumption by 5725 MBtu/Yr at the cost savings of \$43,242 per year. See Energy Requirements Appraisal (ERA) in Special Requirements, Paragraph 3 (SRP-3).</p> <p>D16. PROVISION FOR THE HANDICAPPED:</p> <p>No provisions for the handicapped will be made since the scope of the project is in no way applicable to designing for the handicapped.</p> <p>D17. REAL PROPERTY MAINTENANCE ACTIVITY (RPMA) ANALYSIS:</p> <p>A. Physical impact: There will be light fixtures removed and replace by the same number of light fixtures. No new structures will be added.</p>		

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<p>B. Operations and Maintenance (O&M) impact:</p> <table style="margin-left: auto; margin-right: auto; border: none;"> <thead> <tr> <th style="text-align: left;"><u>YEAR</u></th> <th style="text-align: center;"><u>O&M</u> <u>NET CHANGE (\$000)</u></th> </tr> </thead> <tbody> <tr> <td>1994</td> <td style="text-align: center;">0.0</td> </tr> <tr> <td>(BOD)</td> <td style="text-align: center;">0.0</td> </tr> <tr> <td>1995</td> <td style="text-align: center;">0.0</td> </tr> <tr> <td>1996</td> <td style="text-align: center;">0.0</td> </tr> </tbody> </table> <p>C. Backlog of Maintenance and Repair (BMAR) impact:</p> <p>There will be no net change in the number of fixtures or in fixture life expectancy. There will be no effect on BMAR.</p> <p>D18. COMMERCIAL ACTIVITIES:</p> <p>The proposed project is not a "New Start Expansion" as defined by DA Circular 235-1. The project has been reviewed in light of the requirements of commercial and industrial facilities. It has been determined that whereas the project does not affect commercial facilities, the requirements of DA Circular 235-1 does not apply.</p>			<u>YEAR</u>	<u>O&M</u> <u>NET CHANGE (\$000)</u>	1994	0.0	(BOD)	0.0	1995	0.0	1996	0.0
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<p>SPECIAL REQUIREMENTS PARAGRAPH 1 (SRP-1):</p> <p>Life Cycle Cost Analysis Project Title: Interior/Exterior Lighting Replacements Fiscal Year: 1994 Analysis Date 09/30/93 Economic Life: Fifteen (15) Years</p> <p>1. INVESTMENT</p> <table style="width: 100%;"> <tr><td>A. CONSTRUCTION COST</td><td style="text-align: right;">\$976,010</td></tr> <tr><td>B. SIOH</td><td style="text-align: right;">\$48,801</td></tr> <tr><td>C. DESIGN COST</td><td style="text-align: right;">\$48,801</td></tr> <tr><td>D. ENERGY CREDIT CALC</td><td style="text-align: right;">-0-</td></tr> <tr><td>E. SALVAGE VALUE</td><td style="text-align: right;">-0-</td></tr> <tr><td>F. TOTAL INVESTMENT</td><td style="text-align: right;">\$1,073,612</td></tr> </table> <p>2. ENERGY SAVINGS ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS</p> <table style="width: 100%;"> <thead> <tr> <th style="text-align: left;">FUEL</th> <th style="text-align: center;">COST \$Mbtu (1)</th> <th style="text-align: center;">SAVINGS MBtu/YR(2)</th> <th style="text-align: center;">ANNUAL \$ SAVINGS(3)</th> <th style="text-align: center;">DISCOUNT FACTOR(4)</th> <th style="text-align: center;">DISCOUNTED SAVINGS(5)</th> </tr> </thead> <tbody> <tr><td>A. ELECT</td><td style="text-align: center;">6.18</td><td style="text-align: center;">5725</td><td style="text-align: center;">35,381</td><td style="text-align: center;">11.77</td><td style="text-align: center;">416,429</td></tr> <tr><td>B. DIST</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>C. RESID</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>D. NG</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>E. DEMAND SAVINGS</td><td></td><td></td><td style="text-align: center;">59,268</td><td></td><td></td></tr> <tr><td>F. TOTAL</td><td></td><td style="text-align: center;">5725</td><td style="text-align: center;">94,649</td><td></td><td style="text-align: center;">1,075,489</td></tr> </tbody> </table> <p>3. NON-ENERGY SAVINGS</p> <table style="width: 100%;"> <tr><td>A. ANNUAL RECURRING</td><td></td><td></td><td></td><td></td><td style="text-align: center;">\$12,984</td></tr> <tr><td> (1)DISCOUNT FACTOR</td><td></td><td style="text-align: center;">11.12</td><td></td><td></td><td></td></tr> <tr><td> (2)DISCOUNTED SAVINGS</td><td></td><td></td><td></td><td></td><td style="text-align: center;">\$144,382</td></tr> <tr><td>B. NON-RECURRING SAVINGS</td><td></td><td></td><td></td><td></td><td></td></tr> </table> <table style="width: 100%;"> <thead> <tr> <th style="text-align: left;">ITEM</th> <th style="text-align: center;">SAVINGS(+) COST(-)(1)</th> <th style="text-align: center;">YEAR OF OCCURRENCE(2)</th> <th style="text-align: center;">DISCOUNT FACTOR</th> <th style="text-align: center;">DISCOUNTED SAVINGS(+) COST (-)(4)</th> </tr> </thead> <tbody> <tr><td>a. Replace Interior</td><td style="text-align: center;">418,539</td><td style="text-align: center;">9</td><td style="text-align: center;">0.70</td><td style="text-align: center;">292,977</td></tr> <tr><td>b. Replace Exterior</td><td style="text-align: center;">971,834</td><td style="text-align: center;">8</td><td style="text-align: center;">0.73</td><td style="text-align: center;">71,419</td></tr> <tr><td>c.</td><td></td><td></td><td></td><td></td></tr> <tr><td>d. Total</td><td style="text-align: center;">516,373</td><td></td><td></td><td style="text-align: center;">364,396</td></tr> </tbody> </table> <p>C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+)/COST(-) 508,778</p>			A. CONSTRUCTION COST	\$976,010	B. SIOH	\$48,801	C. DESIGN COST	\$48,801	D. ENERGY CREDIT CALC	-0-	E. SALVAGE VALUE	-0-	F. TOTAL INVESTMENT	\$1,073,612	FUEL	COST \$Mbtu (1)	SAVINGS MBtu/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)	A. ELECT	6.18	5725	35,381	11.77	416,429	B. DIST						C. RESID						D. NG						E. DEMAND SAVINGS			59,268			F. TOTAL		5725	94,649		1,075,489	A. ANNUAL RECURRING					\$12,984	(1)DISCOUNT FACTOR		11.12				(2)DISCOUNTED SAVINGS					\$144,382	B. NON-RECURRING SAVINGS						ITEM	SAVINGS(+) COST(-)(1)	YEAR OF OCCURRENCE(2)	DISCOUNT FACTOR	DISCOUNTED SAVINGS(+) COST (-)(4)	a. Replace Interior	418,539	9	0.70	292,977	b. Replace Exterior	971,834	8	0.73	71,419	c.					d. Total	516,373			364,396
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<p>SPECIAL REQUIREMENTS PARAGRAPH 1 (SRP-1) (continued)</p> <p>D. PROJECT NON ENERGY QUALIFICATION TEST (1) 25% NON ENERGY CALC</p> <table> <tr> <td>4. FIRST YEAR DOLLAR SAVINGS</td> <td>\$142,057</td> </tr> <tr> <td>5. TOTAL NET DISCOUNTED SAVINGS</td> <td>\$1,584,267</td> </tr> <tr> <td>6. DISCOUNTED SAVINGS RATIO</td> <td>1.48</td> </tr> </table>			4. FIRST YEAR DOLLAR SAVINGS	\$142,057	5. TOTAL NET DISCOUNTED SAVINGS	\$1,584,267	6. DISCOUNTED SAVINGS RATIO	1.48
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3. INSTALLATION AND LOCATION Fort Campbell, Kentucky		
4. PROJECT TITLE INTERIOR/EXTERIOR LIGHTING REPLACEMENTS		5. PROJECT NUMBER ECIP #2
<p>SPECIAL REQUIREMENTS PARAGRAPH 3 (SRP-3):</p> <p>Energy Requirements Appraisal (ERA)</p> <p>1. Project Description: Replace existing lighting systems with more efficient lighting systems without reducing the light levels.</p> <p>2. Estimated Energy Consumption: The building are currently lit by standard efficiency lighting. The existing lighting system consumes 9,263 MBtu/Yr of energy. Replacing the existing lighting with high efficiency lighting will result in 5725 MBtu/Yr of electrical energy savings, a sixty-two percent (62%) reduction in current energy consumption.</p> <p>3. Energy Sources: No new energy sources are required for the proposed project. The use of solar energy for this project is impractical.</p> <p>4. Energy Use Impacts: The proposed project will substantially reduce the consumption of electricity for lighting. The burden on the existing base distribution system will be lessened.</p> <p>5. Energy Conservation: The proposed project will reduce annual energy consumption by 5725 MBtu/Yr with annual energy cost savings of \$142,057. The project complies with Army Resources Management Plan (ERMP) and Executive Order 12759.</p> <p>6. Energy Alternatives: The proposed project represents the greatest possible reduction in energy consumption sixty-two percent (62%), without reducing the current lighting levels. The current levels do not exceed the levels recommended by ASHRAE.</p> <p>7. Energy Effects: The proposed project provides positive environmental effects. It reduces the current energy consumption by sixty-two (62%), effectively reducing the consumption of non-renewable fuel sources. The degrading of environmental standards would not make more efficient energy sources available.</p> <p>8. Basis of Approval: Total energy requirements and alternative fuel sources have been considered and included in this appraisal or discarded as applicable.</p>		

**ENERGY SAVINGS OPPORTUNITY SURVEY
FORT CAMPBELL, KENTUCKY
ECO - 5 PROJECT SUMMARY
INTERIOR/EXTERIOR LIGHTING**

BUILDING NUMBER	BUILDING AREA	BASELINE ENERGY (MBTU)	ECO ENERGY (MBTU)	ENERGY SAVINGS (MBTU)	1ST YEAR SAVINGS	INVESTMENT COSTS	SPB (YR)	SIR
38	16,038	449	195	254	\$8,735	\$67,529	7.73	1.44
89	11,545	154	60	94	4,198	37,105	8.84	1.26
95	21,864	316	119	197	6,674	64,308	9.64	1.16
2745	13,249	194	58	136	5,490	30,617	5.58	2.00
3202	13,381	323	103	220	5,802	32,781	5.65	1.99
3204	2,250	27	10	17	601	5,442	9.05	1.24
3206	3,746	16	5	11	369	1,678	4.55	2.47
3207	2,551	56	20	36	1,344	6,944	5.17	2.16
3209	3,598	17	11	6	552	6,403	11.60	.96
3307	2,816	53	23	30	714	6,188	8.66	1.30
3308	2,257	158	142	16	552	4,523	8.2	1.37
5207	169,375	1841	778	1063	25,464	217,736	8.55	1.32
5212	10,880	57	20	37	1,586	10,492	6.69	1.67
5661	22,480	393	165	228	8,832	75,751	8.58	1.30
5702	14,000	90	41	49	1,405	10,203	7.26	1.55
5740	14,173	26	10	16	556	4,182	7.52	1.49
6087	10,768	742	243	499	7,481	35,590	4.76	2.39
6088	4,988	174	59	115	4,458	32,852	7.37	1.52
6254	9,338	201	153	48	1,335	21,578	16.17	.70
6302	5,615	59	18	41	1,611	9,662	6.00	1.86
6304	5,385	60	17	43	1,718	10,518	6.12	1.82
6306	3,108	77	29	48	1,901	12,065	6.35	1.76
6308	5,385	91	30	61	2,086	13,136	6.30	1.78
6390	12,792	212	95	117	2,203	48,997	17.60	.64
6708	2,581	57	24	33	823	6,990	8.49	1.33
6713	3,610	49	21	28	856	8,806	10.29	1.09
6714	2,686	44	22	22	1,050	6,426	6.12	1.82
6715	1,892	177	58	119	3,269	30,180	9.23	1.22
6717	2,581	32	14	18	820	5,011	6.11	1.83
6720	4,892	127	41	86	2,069	9,831	4.75	2.37
6723	3,610	52	19	33	1,436	8,144	5.67	1.97
6729	3,610	45	20	25	1,266	9,875	7.80	1.43
7510	14,280	327	132	195	7,395	68,503	9.26	1.20
7514	4,064	3	1	2	688	6,428	9.35	1.19
7541	8,908	307	117	190	\$3,701	\$33,541	9.06	1.25
7543	998	42	6	36	493	1,617	3.28	3.47
7562	1,800	5	2	3	420	4,047	9.63	1.16
7574	325	1	0	1	201	215	1.07	10.41
PIERCE VILLAGE	N/A	543	159	384	\$5,262	\$26,176	4.97	1.40
LAPORTE VILLAGE	N/A	193	71	122	2,019	11,713	5.80	1.18
HAMMOND HEIGHTS	N/A	459	131	328	4,420	21,539	4.87	1.43
LEE VILLAGE	N/A	1,014	296	718	10,220	48,291	4.73	1.47
TOTALS	437,419	9,263	3,538	5,725	142,057	1,073,612	7.56	1.48

ENERGY SAVINGS OPPORTUNITY SURVEY FORT CAMPBELL, KENTUCKY ECO-5 PROJECT SUMMARY

PAGE 2 OF 2

BUILDING NUMBER	BASELINE ENERGY (MBTU)	ECO ENERGY (MBTU)	ENERGY SAVINGS (MBTU)	1ST YEAR SAVINGS	INVESTMENT COSTS	SPB (YR)	SIR
7541	307	117	190	\$3,701	\$33,541	9.06	1.25
7543	42	6	36	\$493	\$1,617	3.28	3.47
7562	5	2	3	\$420	\$4,047	9.63	1.16
7574	1	0	1	\$201	\$215	1.07	10.41
PIERCE VILLAGE	543	159	384	5262	26176	4.97	1.4
LAPORTE VILLAGE	193	71	122	\$2,019	\$11,713	5.8	1.18
HAMMOND HEIGHTS	459	131	328	\$4,420	\$21,539	4.87	1.43
LEE VILLAGE	1,014	296	718	\$10,220	\$48,291	4.73	1.47
TOTALS	9,263	3,538	5,725	142,057	1,073,612	7.56	1.48

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: ECO5TLT1

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.072

INSTALLATION & LOCATION: FT CAMPBELL REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: 005-TLT1 PHASE 1 LIGHTING

FISCAL YEAR 1994 DISCRETE PORTION NAME: LIGHTING

ANALYSIS DATE: 10-07-93 ECONOMIC LIFE 15 YEARS PREPARED BY: KEITH DERRING

1. INVESTMENT

A. CONSTRUCTION COST	\$	976010.		
B. SIOH	\$	48801.		
C. DESIGN COST	\$	48801.		
D. TOTAL COST (1A+1B+1C)	\$	1073612.		
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$		0.	
F. PUBLIC UTILITY COMPANY REBATE	\$		0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)				\$ 1073612.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1992

FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 6.18	5725.	\$ 35381.	11.77	\$ 416429.
B. DIST	\$ 4.98	0.	\$ 0.	13.83	\$ 0.
C. RESID	\$.00	0.	\$ 0.	16.15	\$ 0.
D. NAT G	\$ 4.00	0.	\$ 0.	15.34	\$ 0.
E. COAL	\$.00	0.	\$ 0.	12.82	\$ 0.
F. PPG	\$.00	0.	\$ 0.	11.12	\$ 0.
M. DEMAND SAVINGS			\$ 59268.	11.12	\$ 659060.
N. TOTAL		5725.	\$ 94649.		\$ 1075489.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 12984.
(1) DISCOUNT FACTOR (TABLE A)	11.12	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 144382.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+)/ COST(-)(4)
1. REPLACE	\$ 97834.	8	.73	71419.
2. REPLACE INTERIOR	\$ 418539.	9	.70	292977.
d. TOTAL	\$ 516373.			364396.

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
INSTALLATION & LOCATION: FT CAMPBELL REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: 005-TLT1 PHASE 1 LIGHTING
FISCAL YEAR 1994 DISCRETE PORTION NAME: LIGHTING
ANALYSIS DATE: 10-07-93 ECONOMIC LIFE 15 YEARS PREPARED BY: KEITH DERRING

STUDY: ECO5TLT1

LCCID 1.072

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 508778.
4. FIRST YEAR DOLLAR SAVINGS $2N3+3A+(3B1d/(YRS\ ECONOMIC\ LIFE))$ \$ 142057.
5. SIMPLE PAYBACK PERIOD (1G/4) 7.56 YEARS
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 1584267.
7. SAVINGS TO INVESTMENT RATIO (SIR)=(5 / 1G)= 1.48
(IF < 1 PROJECT DOES NOT QUALIFY)
8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 6.73 %

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

PAGE 1 OF 3

31 AUGUST 1993

BUILDING WIDE FLUORESCENT FIXTURE REPLACEMENT

BUILDING #: 38

BUILDING USE:

HOURS/DAY 10

DAYS/WEEK 7

ELECTRIC COSTS:

ENERGY CHARGE \$0.0211 PER KWH

DEMAND CHARGE \$11.78 PER KW

EXISTING FIXTURE DATA

REPLACEMENT FIXTURE DATA

4 FOOT

144 1 LAMP @	46 W/FXT =	6912 WATTS	144 1 LAMP @	37 W/FXT =	5328 WATTS
0 1 LAMP @	37.8 W/FXT =	0 WATTS			
54 2 LAMP @	96 W/FXT =	5184 WATTS	54 1 LAMP W/	37 W/FXT =	1998 WATTS
0 2 LAMP @	75.6 W/FXT =	0 WATTS	REFLECTORS		
0 3 LAMP @	144 W/FXT =	0 WATTS	0 2 LAMP W/	58 W/FXT =	0 WATTS
0 3 LAMP @	113.4 W/FXT =	0 WATTS	REFLECTORS		
114 4 LAMP @	192 W/FXT =	21888 WATTS	114 2 LAMP W/	58 W/FXT =	6612 WATTS
0 4 LAMP @	151.2 W/FXT =	0 WATTS	REFLECTORS		

2 FOOT

0 1 LAMP @	31 W/FXT =	0 WATTS	0 1 LAMP @	24 W/FXT =	0 WATTS
0 4 LAMP @	88 W/FXT =	0 WATTS	0 2 LAMP W/	41 W/FXT =	0 WATTS
			REFLECTORS		
0 2 LAMP U @	96 W/FXT =	0 WATTS	0 2 LAMP U @	58 W/FXT =	0 WATTS
0 2 LAMP U @	75.6 W/FXT =	0 WATTS			

8 FOOT

0 2 LAMP @	180 W/FXT =	0 WATTS	0 1 LAMP W/	58 W/FXT =	0 WATTS
0 2 LAMP @	168 W/FXT =	0 WATTS	REFLECTORS		

TOTAL EXISTING KW 34.0

TOTAL REPLACEMENT KW 13.9

NET ENERGY SAVINGS 249.0 MBTU/YR

NET DOLLAR SAVINGS \$4,376.23

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

31 AUGUST 1993

PAGE 2 OF 3

OCCUPANCY SENSOR UTILIZATION AFTER LIGHTING RETROFIT

BUILDING #: 38
 AREA: RESTROOMS
 # OF SENSORS: 2
 HR/DAY 10
 DAY/WEEK 7
 EST HR IN USE/DAY 5
 WATTS 111
 ENERGY SAVINGS 202 KWH

ELECTRIC COSTS:
 ENERGY CHARGE \$0.0211 PER KWH
 DEMAND CHARGE \$11.78 PER KW

NET ENERGY SAVINGS 0.69 MBTU/YR NET DOLLAR SAVINGS \$4.27

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

31 AUGUST 1993

PAGE 3 OF 3

EXIT SIGN REPLACEMENT - INCANDESCENT TO LED

BUILDING #: 38

EXIT SIGNS 4

CURRENT WATTAGE 40

REPLACEMENT WATTAGE 3

HOURS/YEAR 8760

ELECTRIC COSTS:
ENERGY CHARGE \$0.0211 PER KWH

DEMAND CHARGE \$11.78 PER KW

NET ENERGY SAVINGS

4.42 MBTU/YR

NET DOLLAR SAVINGS

\$48.33

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 09:08:59

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-5: BUILDING 38

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93
Current UPB/CSI ID: ORL290

H - C A C E S E D I T I O N
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Release 4.20

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0038E5
4-33

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 38

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Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-5: BUILDING 38
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 09:08:59

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL		QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16500 LIGHTING										
16512 7000 FLUORESCENT - RECESSED T8 ELECTRONIC BALLAST										
CD=3 EL 7001	4 FT 1 LAMP PARABOLIC LOUVRE	*** UNIT COSTS: ***			0.57	18.86	0.07	105.25	5.26	129.45
WC=1100		144.00 EA EELEB		82		2,716	11	15,156	758	18,641
CD=3 EL 7002	4 FT 1 LAMP PARABOLIC LOUVRE W/ REFLECTOR	*** UNIT COSTS: ***			0.54	17.84	0.07	122.00	6.10	146.01
WC=1100		54.00 EA EELEB		29		964	4	6,588	329	7,885
CD=3 EL 7003	4 FT 2 LAMP PARABOLIC LOUVRE W/ REFLECTOR	*** UNIT COSTS: ***			0.59	19.42	0.08	136.00	6.80	162.29
WC=1100		114.00 EA EELEB		67		2,214	9	15,504	775	18,501
16530 1100 SURFACE OR PENDANT MOUNTED										
CD=3 EL 1118	LED EXIT SIGN W/ BATTERY	*** UNIT COSTS: ***			1.25	41.26	0.00	121.45	6.07	168.79
WC=1100		4.00 EA EELEA		5		165	0	486	24	675
16900 CONTROLS AND INSTRUMENTATION										
16930 3000 OCCUPANCY SENSORS										
CD=3 EL 3001	OCCUPANCY SENSOR, 1800 W MAX	*** UNIT COSTS: ***			0.50	16.51	0.06	48.00	2.40	66.97
WC=1100		2.00 EA EELEB		1		33	0	96	5	134
TOTAL DIVISION 16 ELECTRICAL					185	6,091	23	37,830	1,891	45,836
TOTAL FACILITY AA. ELECTRICAL					185	6,091	23	37,830	1,891	45,836
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE					185	6,091	23	37,830	1,891	45,836
TOTAL BASE BID					185	6,091	23	37,830	1,891	45,836
TOTAL ADDITIVE					0	0	0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY					185	6,091	23	37,830	1,891	45,836

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0038E5
4-35

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 38

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PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-5: INTERIOR LIGHTING

SCOPE OF WORK: EVALUATE USE OF HIGHER EFFICIENCY INTERIOR LIGHTING IN
SELECTED FACILITIES AT FT CAMPBELL.

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
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ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY	COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	45,836	10.0%	0.0%	7.5%	2.5%	0.0%	
			4,584	0	3,781	1,355	0	55,556	55555.99
BID ITEM TOTAL	1.00 EA	45,836	4,584	0	3,781	1,355	0	55,556	55555.99
TOTAL BASE BID		45,836	4,584	0	3,781	1,355	0	55,556	
TOTAL ADDITIVE		0	0	0	0	0	0	0	
TOTAL INCL ADD		45,836	4,584	0	3,781	1,355	0	55,556	

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0038E5
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U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
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PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
1.	BUILDING TO THE 5 FOOT LINE	1.00	EA	55,556		55,556	55556.00
	TOTAL CURRENT CONTRACT COST			55,556	0	55,556	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			55,556	0	55,556	
	Government-Furnished Property			0		0	
	SUBTOTAL			55,556	0	55,556	
	Contingencies	10.0%		5,556	0	5,556	
	SUBTOTAL			61,112	0	61,112	
	SIOH (S&A)	5.5%		3,361	0	3,361	
	CURRENT WORKING ESTIMATE			64,473	0	64,473	
	Estimated Construction Time	365	Days				

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0038E5
4-38

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
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CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT **	SUBCON	W/OH&P	SUBTOTAL
										AMOUNT PCT			
AA	GENERAL/PRIME		1.00	EA	185	6,091	23	39,721		45,836 100.0%	0		45,836
	TOTAL DIRECT				185	6,091	23	39,721		45,836 100.0%			

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0038E5
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Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
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CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 1

ID	CONTRACTOR	PH	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOPC%	**** PROFIT ****	AMOUNT	PCT	BOND%	OTHER%	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		45,836	4,584	10.0%	0.0		3,781	7.5%	2.5%	0.0%		55,556	100.0%		55555.96
	TOTAL OVERHEAD & PROFIT			4,584	10.0%			3,781	7.5%							

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 38

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CSI DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
16 ELECTRICAL	185	6,091	23	37,830	1,891	45,836
TOTAL DIRECT	185	6,091	23	37,830	1,891	45,836

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0038E5

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Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 38

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SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
11 INTERIOR ELECTRICAL	185	6,091	23	37,830	1,891	45,836
TOTAL DIRECT	185	6,091	23	37,830	1,891	45,836

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0038E5
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U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 38

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EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP DESCRIPTION	LIFE HRS	TL	HRLY	OWNRSH	ADJ FACTOR	ADJUSTD	BOOK OP	--	HRLY	---	UPB	****	TOTAL	****
					OWNS	OVTM	OWNRSH	EXPENSE	RATE		RATE	HOURS		COST
EMI20 SMALL TOOLS									1.40		1.40	17		23
TOTAL PROJECT EQUIPMENT HOURS												17		23

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 38

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LABOR SUMMARY

SUMMARY PAGE 9

CRAFT DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LELEC ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	185	6,091
TOTAL PROJECT MANHOURS								185	6,091

*** END OF SUMMARY REPORT ***

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

PAGE 1 OF 3

31 AUGUST 1993

BUILDING WIDE FLUORESCENT FIXTURE REPLACEMENT

BUILDING #: 89

BUILDING USE: _____

HOURS/DAY: 9

DAYS/WEEK: 5

ELECTRIC COSTS:

ENERGY CHARGE: \$0.0211 PER KWH

DEMAND CHARGE: \$11.78 PER KW

EXISTING FIXTURE DATA

4 FOOT

0.1 LAMP @ 48 W/FXT = 0 WATTS

0.1 LAMP @ 37.8 W/FXT = 0 WATTS

147 2 LAMP @ 96 W/FXT = 14112 WATTS

0.2 LAMP @ 75.6 W/FXT = 0 WATTS

0.3 LAMP @ 144 W/FXT = 0 WATTS

0.3 LAMP @ 113.4 W/FXT = 0 WATTS

18 4 LAMP @ 192 W/FXT = 3456 WATTS

0.4 LAMP @ 151.2 W/FXT = 0 WATTS

2 FOOT

0.1 LAMP @ 31 W/FXT = 0 WATTS

0.4 LAMP @ 88 W/FXT = 0 WATTS

0.2 LAMP U @ 96 W/FXT = 0 WATTS

0.2 LAMP U @ 75.6 W/FXT = 0 WATTS

8 FOOT

0.2 LAMP @ 180 W/FXT = 0 WATTS

0.2 LAMP @ 168 W/FXT = 0 WATTS

TOTAL EXISTING KW 17.6

NET ENERGY SAVINGS 88.5 MBTU/YR

REPLACEMENT FIXTURE DATA

4 FOOT

0.1 LAMP @ 37 W/FXT = 0 WATTS

147 1 LAMP W/ REFLECTORS 37 W/FXT = 5439 WATTS

0.2 LAMP W/ REFLECTORS 58 W/FXT = 0 WATTS

18 2 LAMP W/ REFLECTORS 58 W/FXT = 1044 WATTS

2 FOOT

0.1 LAMP @ 24 W/FXT = 0 WATTS

0.2 LAMP W/ REFLECTORS 41 W/FXT = 0 WATTS

0.2 LAMP U @ 58 W/FXT = 0 WATTS

8 FOOT

0.1 LAMP W/ REFLECTORS 58 W/FXT = 0 WATTS

TOTAL REPLACEMENT KW 6.5

NET DOLLAR SAVINGS \$2,115.32

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

PAGE 2 OF 3

31 AUGUST 1993

BUILDING WIDE INCANDESCENT LAMP REPLACEMENT

BUILDING #: 89

LAMP USE:

HOURS/DAY 3

DAYS/WEEK 5

PEAK USE 2 (1 - YES, 2 - NO)

ELECTRIC COSTS:

ENERGY CHARGE \$0.0211 PER KWH

DEMAND CHARGE \$0.00 PER KW

EXISTING INCANDESCENTS

0 LAMPS @ 25 WATTS =	0 WATTS
0 LAMPS @ 40 WATTS =	0 WATTS
0 LAMPS @ 52 WATTS =	0 WATTS
1 LAMPS @ 60 WATTS =	60 WATTS
0 LAMPS @ 75 WATTS =	0 WATTS
0 LAMPS @ 90 WATTS =	0 WATTS
0 LAMPS @ 100 WATTS =	0 WATTS
TOTAL EXISTING WATTS	60

COMPACT FLUORESCENT REPLACEMENT

0 LAMPS @ 7 WATTS =	0 WATTS
0 LAMPS @ 9 WATTS =	0 WATTS
1 LAMPS @ 13 WATTS =	13 WATTS
0 LAMPS @ 18 WATTS =	0 WATTS
0 LAMPS @ 26 WATTS =	0 WATTS
TOTAL REPLACEMENT WATTS	13

NET ENERGY SAVINGS 0.12 MBTU/YR

NET DOLLAR SAVINGS \$0.77

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

31 AUGUST 1993

PAGE 3 OF 3

EXIT SIGN REPLACEMENT -- INCANDESCENT TO LED

BUILDING #: 89

EXIT SIGNS 5

CURRENT WATTAGE 40

REPLACEMENT WATTAGE 3

HOURS/YEAR 8760

ELECTRIC COSTS:
ENERGY CHARGE \$0.0211 PER KWH

DEMAND CHARGE \$11.78 PER KW

NET ENERGY SAVINGS

5.52 MBTU/YR

NET DOLLAR SAVINGS

\$60.41

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 09:37:02

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-5: BUILDING 89

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93
Current UPB/CSI ID: ORL290

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CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0089E5
4-48

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 89

TIME 09:37:02

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Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-5: BUILDING 89
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 09:37:02

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL		QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16500 LIGHTING										
16512 6100 SMALL FL FIXTURES (LESS THAN 40 WATT LAMPS)										
CD=3 EL 6105	SURF SQ W/1 13W BIAxIAL FL LAMP	***	UNIT COSTS: ***	1.25		41.26	0.00	27.80	1.39	70.45
WC=1100	WHITE ACRYLIC LENS	1.00	EA EELEA	1		41	0	28	1	70
16512 7000 FLUORESCENT - RECESSED T8 ELECTRONIC BALLAST										
CD=3 EL 7002	4 FT 1 LAMP PARABOLIC LOUVRE W/	***	UNIT COSTS: ***	0.54		17.84	0.07	122.00	6.10	146.01
WC=1100	REFLECTOR	147.00	EA EELEB	79		2,623	10	17,934	897	21,464
CD=3 EL 7003	4 FT 2 LAMP PARABOLIC LOUVRE W/	***	UNIT COSTS: ***	0.59		19.42	0.08	136.00	6.80	162.29
WC=1100	REFLECTOR	18.00	EA EELEB	11		350	1	2,448	122	2,921
16530 1100 SURFACE OR PENDANT MOUNTED										
CD=3 EL 1118	LED EXIT SIGN W/ BATTERY	***	UNIT COSTS: ***	1.25		41.26	0.00	121.45	6.07	168.79
WC=1100		5.00	EA EELEA	6		206	0	607	30	844
TOTAL DIVISION 16 ELECTRICAL						98	3,220	12	21,017	1,051 25,300
TOTAL FACILITY AA. ELECTRICAL						98	3,220	12	21,017	1,051 25,300
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE						98	3,220	12	21,017	1,051 25,300
TOTAL BASE BID						98	3,220	12	21,017	1,051 25,300
TOTAL ADDITIVE						0	0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY						98	3,220	12	21,017	1,051 25,300

*** END OF DETAIL REPORT ***

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0089E5
 4-50

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 89

TIME 09:37:02

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-5: INTERIOR LIGHTING

SCOPE OF WORK: EVALUATE USE OF HIGHER EFFICIENCY INTERIOR LIGHTING IN
SELECTED FACILITIES AT FT CAMPBELL.

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 89

TIME 09:37:02

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	25,300	10.0% 2,530	0.0% 0	7.5% 2,087	2.5% 748	0.0% 0	30,665	30664.66
<hr/>										
BID ITEM TOTAL		1.00 EA	25,300	2,530	0	2,087	748	0	30,665	30664.66
<hr/>										
TOTAL BASE BID			25,300	2,530	0	2,087	748	0	30,665	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
<hr/>										
TOTAL INCL ADD			25,300	2,530	0	2,087	748	0	30,665	

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 89

TIME 09:37:02

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
	1. BUILDING TO THE 5 FOOT LINE	1.00	EA	30,665		30,665	30664.70
	TOTAL CURRENT CONTRACT COST			30,665	0	30,665	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%		0	0	0	
	ESCALATED CONTRACT COST			30,665	0	30,665	
	Government-Furnished Property			0		0	
	SUBTOTAL			30,665	0	30,665	
	Contingencies	10.0%		3,066	0	3,066	
	SUBTOTAL			33,731	0	33,731	
	SIOH (S&A)	5.0%		1,687	0	1,687	
	CURRENT WORKING ESTIMATE			35,418	0	35,418	
	Estimated Construction Time	365	Days				

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0089E5
4-53

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 89

TIME 09:37:02

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PH	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT *	* SUBCON *	W/OH&P	SUBTOTAL
										AMOUNT	PCT		
AA	GENERAL/PRIME		1.00	EA	98	3,220	12	22,068		25,300	100.0%	0	25,300
	TOTAL DIRECT				98	3,220	12	22,068		25,300	100.0%		

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS H-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 89

TIME 09:37:0.

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE

ID	CONTRACTOR	PH	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOFCT	**** PROFIT ****	AMOUNT	PCT	BOND% OTHER%	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COS
AA	GENERAL/PRIME		25,300	2,530	10.0%	0.0		2,087	7.5%	2.5%	0.0%	30,665	100.0%		30664.6
	TOTAL OVERHEAD & PROFIT			2,530	10.0%			2,087	7.5%						

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 89

TIME 09:37:01

CSI DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
16 ELECTRICAL	98	3,220	12	21,017	1,051	25,300
TOTAL DIRECT	98	3,220	12	21,017	1,051	25,300

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 89

TIME 09:37:02

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
11 INTERIOR ELECTRICAL	98	3,220	12	21,017	1,051	25,300
TOTAL DIRECT	98	3,220	12	21,017	1,051	25,300

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0089E5
4-57

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 89

TIME 09:37:01

EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP DESCRIPTION	LIFE HRS	TL HRLY	OWNRSHP	OWNS	OVTM	OWNRSHP	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
EMI20 SMALL TOOLS								1.40	1.40	8	12
TOTAL PROJECT EQUIPMENT HOURS										8	12

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 89

TIME 09:37:01

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LELEC ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	98	3,220
TOTAL PROJECT MANHOURS								98	3,220

* * * END OF SUMMARY REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0089E5
4-59

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

PAGE 1 OF 2

31 AUGUST 1993

BUILDING WIDE FLUORESCENT FIXTURE REPLACEMENT

BUILDING #: 95

BUILDING USE: _____

HOURS/DAY: 10

DAYS/WEEK: 5

ELECTRIC COSTS:

ENERGY CHARGE \$0.0211 PER KWH

DEMAND CHARGE \$11.78 PER KW

EXISTING FIXTURE DATA

REPLACEMENT FIXTURE DATA

4 FOOT

01 LAMP @ 48 W/FIXT = 0 WATTS

01 LAMP @ 37.6 W/FIXT = 0 WATTS

145 2 LAMP @ 96 W/FIXT = 13920 WATTS

02 LAMP @ 75.6 W/FIXT = 0 WATTS

03 LAMP @ 144 W/FIXT = 0 WATTS

03 LAMP @ 113.4 W/FIXT = 0 WATTS

17 4 LAMP @ 192 W/FIXT = 3264 WATTS

121 4 LAMP @ 151.2 W/FIXT = 18295.2 WATTS

4 FOOT

01 LAMP @ 37 W/FIXT = 0 WATTS

145 1 LAMP W/ REFLECTORS 5365 WATTS

02 LAMP W/ REFLECTORS 0 WATTS

138 2 LAMP W/ REFLECTORS 8004 WATTS

2 FOOT

01 LAMP @ 31 W/FIXT = 0 WATTS

04 LAMP @ 88 W/FIXT = 0 WATTS

02 LAMP U @ 96 W/FIXT = 0 WATTS

02 LAMP U @ 75.6 W/FIXT = 0 WATTS

2 FOOT

01 LAMP @ 24 W/FIXT = 0 WATTS

02 LAMP W/ REFLECTORS 0 WATTS

02 LAMP U @ 58 W/FIXT = 0 WATTS

8 FOOT

02 LAMP @ 180 W/FIXT = 0 WATTS

02 LAMP @ 168 W/FIXT = 0 WATTS

8 FOOT

01 LAMP W/ REFLECTORS 0 WATTS

TOTAL EXISTING KW 35.5

TOTAL REPLACEMENT KW 13.4

NET ENERGY SAVINGS 196.1 MBTU/YR

NET DOLLAR SAVINGS \$4,340.76

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

31 AUGUST 1993

PAGE 2 OF 2

BUILDING WIDE INCANDESCENT LAMP REPLACEMENT

BUILDING #: 95

LAMP USE:

HOURS/DAY 10

DAYS/WEEK 5

PEAK USE 1 (1 - YES, 2 - NO)

ELECTRIC COSTS:

ENERGY CHARGE \$0.0211 PER KWH

DEMAND CHARGE \$11.78 PER KW

EXISTING INCANDESCENTS

0 LAMPS @	25	WATTS =	0	WATTS
4 LAMPS @	40	WATTS =	160	WATTS
0 LAMPS @	52	WATTS =	0	WATTS
0 LAMPS @	60	WATTS =	0	WATTS
0 LAMPS @	75	WATTS =	0	WATTS
0 LAMPS @	90	WATTS =	0	WATTS
0 LAMPS @	100	WATTS =	0	WATTS

TOTAL EXISTING WATTS 160

COMPACT FLUORESCENT REPLACEMENT

0 LAMPS @	7	WATTS =	0	WATTS
4 LAMPS @	9	WATTS =	36	WATTS
0 LAMPS @	13	WATTS =	0	WATTS
0 LAMPS @	18	WATTS =	0	WATTS
0 LAMPS @	26	WATTS =	0	WATTS

TOTAL REPLACEMENT WATTS 36

NET ENERGY SAVINGS 1.10 MBTU/YR

NET DOLLAR SAVINGS \$24.34

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 10:00:53

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-5: BUILDING 95

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93

Current UPB/CSI ID: ORL290

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CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0095E5
4-62

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 95

TIME 10:00:53

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Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-5: BUILDING 95
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 10:00:53

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL		QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$

16500 LIGHTING										
16512 6100 SMALL FL FIXTURES (LESS THAN 40 WATT LAMPS)										
CD=3 EL 6104	SURF SQ W/1 9W BIAxIAL FL LAMP	***	UNIT COSTS: ***	1.25		41.26	0.00	27.50	1.38	70.14
WC=1100	WHITE ACRYLIC LENS	4.00	EA EELEA	5		165	0	110	6	281
16512 7000 FLUORESCENT - RECESSED T8 ELECTRONIC BALLAST										
CD=3 EL 7002	4 FT 1 LAMP PARABOLIC LOUVRE W/	***	UNIT COSTS: ***	0.54		17.84	0.07	122.00	6.10	146.01
WC=1100	REFLECTOR	145.00	EA EELEB	78		2,587	10	17,690	885	21,172
CD=3 EL 7003	4 FT 2 LAMP PARABOLIC LOUVRE W/	***	UNIT COSTS: ***	0.59		19.42	0.08	136.00	6.80	162.29
WC=1100	REFLECTOR	138.00	EA EELEB	81		2,680	10	18,768	938	22,397
TOTAL DIVISION 16 ELECTRICAL						165	5,432	21	36,568	1,828 43,849
TOTAL FACILITY AA. ELECTRICAL						165	5,432	21	36,568	1,828 43,849
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE						165	5,432	21	36,568	1,828 43,849
TOTAL BASE BID						165	5,432	21	36,568	1,828 43,849
TOTAL ADDITIVE						0	0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY						165	5,432	21	36,568	1,828 43,849

*** END OF DETAIL REPORT ***

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0095E5
 4-64

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 95

TIME 10:00:53

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-5: INTERIOR LIGHTING

SCOPE OF WORK: EVALUATE USE OF HIGHER EFFICIENCY INTERIOR LIGHTING IN
SELECTED FACILITIES AT FT CAMPBELL.

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0095E5
4-65

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 95

TIME 10:00:51

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 1

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OPC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL			10.0%	0.0%	7.5%	2.5%	0.0%		
		1.00 EA	43,849	4,385	0	3,618	1,296	0	53,148	53147.60
<hr/>										
BID ITEM TOTAL		1.00 EA	43,849	4,385	0	3,618	1,296	0	53,148	53147.60
<hr/>										
TOTAL BASE BID			43,849	4,385	0	3,618	1,296	0	53,148	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
<hr/>										
TOTAL INCL ADD			43,849	4,385	0	3,618	1,296	0	53,148	

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 95

TIME 10:00:51

PROJECT CWE SUMMARY

SUMMARY PAGE 1

ID	BID ITEM	QUANTITY UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
1.	BUILDING TO THE 5 FOOT LINE	1.00 EA	53,148		53,148	53147.70
	TOTAL CURRENT CONTRACT COST		53,148	0	53,148	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%	0	0	0	
	ESCALATED CONTRACT COST		53,148	0	53,148	
	Government-Furnished Property		0		0	
	SUBTOTAL		53,148	0	53,148	
	Contingencies	10.0%	5,315	0	5,315	
	SUBTOTAL		58,462	0	58,462	
	SIOH (S&A)	5.0%	2,923	0	2,923	
	CURRENT WORKING ESTIMATE		61,386	0	61,386	

Estimated Construction Time 365 Days

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0095E5
4-67

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 95

TIME 10:00:53

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT W/TX	** TOTAL DIRECT *	** SUBCON *	W/OH&P	SUBTOTAL
									AMOUNT	PCT		
AA	GENERAL/PRIME		1.00	EA	165	5,432	21	38,396	43,849	100.0%	0	43,849
	TOTAL DIRECT				165	5,432	21	38,396	43,849	100.0%		

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 95

TIME 10:00:51

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 1

ID	CONTRACTOR	PM	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOFC%	**** PROFIT ****	AMOUNT	PCT	BOND%	OTHER%	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		43,849	4,385	10.0%	0.0		3,618	7.5%	2.5%	0.0%		53,148	100.0%		53147.6%
	TOTAL OVERHEAD & PROFIT			4,385	10.0%			3,618	7.5%							

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0095E5
4-69

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 95

TIME 10:00:53

CSI DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
16 ELECTRICAL	165	5,432	21	36,568	1,828	43,849
TOTAL DIRECT	165	5,432	21	36,568	1,828	43,849

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0095E5
4-70

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 95

TIME 10:00:53

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
11 INTERIOR ELECTRICAL	165	5,432	21	36,568	1,828	43,849
TOTAL DIRECT	165	5,432	21	36,568	1,828	43,849

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0095E5
4-71

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 95

TIME 10:00:53

EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
EMI20 SMALL TOOLS								1.40	1.40	15	21
TOTAL PROJECT EQUIPMENT HOURS										15	21

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 95

TIME 10:00:53

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT DESCRIPTION	BASE	OVERTM	TYS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LELEC ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	165	5,432
TOTAL PROJECT MANHOURS								165	5,432

*** END OF SUMMARY REPORT ***

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 0095E5
4-73

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

PAGE 1 OF 4

31 AUGUST 1993

BUILDING WIDE FLUORESCENT FIXTURE REPLACEMENT

BUILDING #: 2745

BUILDING USE:

HOURS/DAY 9

DAYS/WEEK 5

ELECTRIC COSTS:

ENERGY CHARGE \$0.0211 PER KWH

DEMAND CHARGE \$11.78 PER KW

EXISTING FIXTURE DATA

4 FOOT

2 1 LAMP @ 48 W/FXT = 96 WATTS
 0 1 LAMP @ 37.8 W/FXT = 0 WATTS
 7 2 LAMP @ 96 W/FXT = 672 WATTS
 0 2 LAMP @ 75.6 W/FXT = 0 WATTS
 4 3 LAMP @ 144 W/FXT = 576 WATTS
 0 3 LAMP @ 113.4 W/FXT = 0 WATTS
 108 4 LAMP @ 192 W/FXT = 20736 WATTS
 0 4 LAMP @ 151.2 W/FXT = 0 WATTS

REPLACEMENT FIXTURE DATA

4 FOOT

2 1 LAMP @ 37 W/FXT = 74 WATTS
 7 1 LAMP W/ REFLECTORS 37 W/FXT = 259 WATTS
 4 2 LAMP W/ REFLECTORS 58 W/FXT = 232 WATTS
 108 2 LAMP W/ REFLECTORS 58 W/FXT = 6264 WATTS

2 FOOT

0 1 LAMP @ 31 W/FXT = 0 WATTS
 0 4 LAMP @ 88 W/FXT = 0 WATTS
 0 2 LAMP U @ 96 W/FXT = 0 WATTS
 0 2 LAMP U @ 75.6 W/FXT = 0 WATTS

8 FOOT

0 2 LAMP @ 180 W/FXT = 0 WATTS
 0 2 LAMP @ 168 W/FXT = 0 WATTS

TOTAL EXISTING KW

22.1

TOTAL REPLACEMENT KW

6.8

NET ENERGY SAVINGS

121.8 MBTU/YR

NET DOLLAR SAVINGS

\$2,910.31

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

31 AUGUST 1993

PAGE 2 OF 4

OCCUPANCY SENSOR UTILIZATION AFTER LIGHTING RETROFIT

BUILDING #: 2745
 AREA: RESTROOMS
 # OF SENSORS: 3
 HR/DAY 9
 DAY/WEEK 5
 EST HR IN USE/DAY 4.5
 WATTS 522
 ENERGY SAVINGS 611 KWH

ELECTRIC COSTS:
 ENERGY CHARGE \$0.0211 PER KWH
 DEMAND CHARGE \$11.78 PER KW

NET ENERGY SAVINGS 2.08 MBTU/YR NET DOLLAR SAVINGS \$12.91

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

31 AUGUST 1993

PAGE 3 OF 4

BUILDING WIDE INCANDESCENT LAMP REPLACEMENT

BUILDING #: 2745

LAMP USE:

HOURS/DAY 9

DAYS/WEEK 5

PEAK USE 1 (1 - YES, 2 - NO)

ELECTRIC COSTS:

ENERGY CHARGE \$0.0211 PER KWH

DEMAND CHARGE \$11.78 PER KW

EXISTING INCANDESCENTS

0 LAMPS @ 25 WATTS =	0 WATTS
0 LAMPS @ 40 WATTS =	0 WATTS
0 LAMPS @ 52 WATTS =	0 WATTS
3 LAMPS @ 60 WATTS =	180 WATTS
0 LAMPS @ 75 WATTS =	0 WATTS
0 LAMPS @ 90 WATTS =	0 WATTS
0 LAMPS @ 100 WATTS =	0 WATTS
TOTAL EXISTING WATTS	180

COMPACT FLUORESCENT REPLACEMENT

0 LAMPS @ 7 WATTS =	0 WATTS
0 LAMPS @ 9 WATTS =	0 WATTS
3 LAMPS @ 13 WATTS =	39 WATTS
0 LAMPS @ 18 WATTS =	0 WATTS
0 LAMPS @ 26 WATTS =	0 WATTS
TOTAL REPLACEMENT WATTS	39

NET ENERGY SAVINGS 1.12 MBTU/YR

NET DOLLAR SAVINGS \$26.91

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

31 AUGUST 1983

PAGE 4 OF 4

EXIT SIGN REPLACEMENT -- INCANDESCENT TO LED

BUILDING #: 2745

EXIT SIGNS 10
CURRENT WATTAGE 40
REPLACEMENT WATTAGE 3
HOURS/YEAR 8760

ELECTRIC COSTS:
ENERGY CHARGE \$0.0211 PER KWH
DEMAND CHARGE \$11.78 PER KW

NET ENERGY SAVINGS

11.0 MBTU/YR

NET DOLLAR SAVINGS

\$120.82

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 10:18:3

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-5: BUILDING 2745

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93
Current UPB/CSI ID: ORL290

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CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 2745EE
4-78

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 2745

TIME 10:18:3

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Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-5: BUILDING 2745
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 10:18:31

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL		QUANTITY	DOM CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTY	DIRECT \$
16500 LIGHTING									
16512 6100 SMALL FL FIXTURES (LESS THAN 40 WATT LAMPS)									
CD=3 EL 6105	SURF SQ W/1 13W BIAXIAL FL LAMP *** UNIT COSTS: ***	1.25			41.26	0.00	27.80	1.39	70.45
WC=1100	WHITE ACRYLIC LENS 3.00 EA EELEA	4			124	0	83	4	211
16512 7000 FLUORESCENT - RECESSED T8 ELECTRONIC BALLAST									
CD=3 EL 7001	4 FT 1 LAMP PARABOLIC LOUVRE *** UNIT COSTS: ***	0.57			18.86	0.07	105.25	5.26	129.45
WC=1100	2.00 EA EELEB	1			38	0	211	11	259
CD=3 EL 7002	4 FT 1 LAMP PARABOLIC LOUVRE W/ *** UNIT COSTS: ***	0.54			17.84	0.07	122.00	6.10	146.01
WC=1100	REFLECTOR 7.00 EA EELEB	4			125	0	854	43	1,022
CD=3 EL 7003	4 FT 2 LAMP PARABOLIC LOUVRE W/ *** UNIT COSTS: ***	0.59			19.42	0.08	136.00	6.80	162.29
WC=1100	REFLECTOR 112.00 EA EELEB	66			2,175	8	15,232	762	18,177
16530 1100 SURFACE OR PENDANT MOUNTED									
CD=3 EL 1118	LED EXIT SIGN W/ BATTERY *** UNIT COSTS: ***	1.25			41.26	0.00	121.45	6.07	168.79
WC=1100	10.00 EA EELEA	13			413	0	1,215	61	1,688
16900 CONTROLS AND INSTRUMENTATION									
16930 3000 OCCUPANCY SENSORS									
CD=3 EL 3001	OCCUPANCY SENSOR, 1800 W MAX *** UNIT COSTS: ***	0.50			16.51	0.06	48.00	2.40	66.97
WC=1100	3.00 EA EELEB	2			50	0	144	7	201
TOTAL DIVISION 16 ELECTRICAL		89			2,923	9	17,738	887	21,558
TOTAL FACILITY AA. ELECTRICAL		89			2,923	9	17,738	887	21,558
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE		89			2,923	9	17,738	887	21,558
TOTAL BASE BID		89			2,923	9	17,738	887	21,558
TOTAL ADDITIVE		0			0	0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY		89			2,923	9	17,738	887	21,558

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 2745E5
4-80

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 2745

TIME 10:18:31

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-5: INTERIOR LIGHTING

SCOPE OF WORK: EVALUATE USE OF HIGHER EFFICIENCY INTERIOR LIGHTING IN
SELECTED FACILITIES AT FT CAMPBELL.

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-5: BUILDING 2745

TIME 10:18:31

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER FCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	21,558	10.0% 2,156	0.0% 0	7.5% 1,779	2.5% 637	0.0% 0	26,130	26129.63
BID ITEM TOTAL		1.00 EA	21,558	2,156	0	1,779	637	0	26,130	26129.63
TOTAL BASE BID			21,558	2,156	0	1,779	637	0	26,130	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
TOTAL INCL ADD			21,558	2,156	0	1,779	637	0	26,130	

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 2745

TIME 10:18:31

PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
1.	BUILDING TO THE 5 FOOT LINE	1.00 EA	26,130		26,130	26129.60
	TOTAL CURRENT CONTRACT COST		26,130	0	26,130	
	Cost Growth from 08/93 to 08/94 Index Values: 0000 0000	0.0%	0	0	0	
	ESCALATED CONTRACT COST		26,130	0	26,130	
	Government-Furnished Property		0		0	
	SUBTOTAL		26,130	0	26,130	
	Contingencies	10.0%	2,613	0	2,613	
	SUBTOTAL		28,743	0	28,743	
	SIOH (S&A)	5.0%	1,437	0	1,437	
	CURRENT WORKING ESTIMATE		30,180	0	30,180	
	Estimated Construction Time	365 Days				

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 2745

TIME 10:18:31

CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PH	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	** TOTAL DIRECT *	* SUBCON *	W/OH&P	SUBTOTAL
						AMOUNT	PCT						
AA	GENERAL/PRIME		1.00	EA	89	2,923		9	18,625	21,558	100.0%	0	21,558
	TOTAL DIRECT				89	2,923		9	18,625	21,558	100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 2745E5

4-84

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 2745

TIME 10:18:31

CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PM	SUBTOTAL	*** OVERHEAD ***	AMOUNT	PCT	HOFC%	**** PROFIT ****	AMOUNT	PCT	BOND%	OTHER%	***** TOTAL CONTRACT *****	AMOUNT	PCT	UNIT COST
AA	GENERAL/PRIME		21,558	2,156	10.0%	0.0		1,779	7.5%	2.5%	0.0%		26,130	100.0%		26129.62
	TOTAL OVERHEAD & PROFIT			2,156	10.0%			1,779	7.5%							

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 2745E5
4-85

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 2745

TIME 10:18:31

CSI DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
16 ELECTRICAL	89	2,923	9	17,738	887	21,558
TOTAL DIRECT	89	2,923	9	17,738	887	21,558

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 2745E5
4-86

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 2745

TIME 10:18:31

SYSTEMS SUMMARY

SUMMARY PAGE 7

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
11 INTERIOR ELECTRICAL	89	2,923	9	17,738	887	21,558
TOTAL DIRECT	89	2,923	9	17,738	887	21,558

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 2745E5
4-87

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 2745

TIME 10:18:31

EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP DESCRIPTION	LIFE HRS	TL HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
EMI20 SMALL TOOLS								1.40	1.40	7	9
TOTAL PROJECT EQUIPMENT HOURS										7	9

Thu 26 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 2745

TIME 10:18:31

LABOR SUMMARY

SUMMARY PAGE 9

CRAFT DESCRIPTION	BASE	OVERTM	TYS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LELEC ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	89	2,923
TOTAL PROJECT MANHOURS								89	2,923

* * * END OF SUMMARY REPORT * * *

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 5: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

PAGE 1 OF 2

31 AUGUST 1993

BUILDING WIDE FLUORESCENT FIXTURE REPLACEMENT

BUILDING #: 3202

BUILDING USE:

HOURS/DAY 10

DAYS/WEEK 7

ELECTRIC COSTS:
ENERGY CHARGE \$0.0211 PER KWH
DEMAND CHARGE \$11.76 PER KW

EXISTING FIXTURE DATA

4 FOOT

0 1 LAMP @ 48 W/FXT = 0 WATTS
0 1 LAMP @ 37.8 W/FXT = 0 WATTS
6 2 LAMP @ 96 W/FXT = 576 WATTS
0 2 LAMP @ 75.6 W/FXT = 0 WATTS
0 3 LAMP @ 144 W/FXT = 0 WATTS
0 3 LAMP @ 113.4 W/FXT = 0 WATTS
125 4 LAMP @ 192 W/FXT = 24000 WATTS
0 4 LAMP @ 151.2 W/FXT = 0 WATTS

2 FOOT

0 1 LAMP @ 31 W/FXT = 0 WATTS
0 4 LAMP @ 88 W/FXT = 0 WATTS
0 2 LAMP U @ 96 W/FXT = 0 WATTS
0 2 LAMP U @ 75.6 W/FXT = 0 WATTS

8 FOOT

0 2 LAMP @ 180 W/FXT = 0 WATTS
0 2 LAMP @ 168 W/FXT = 0 WATTS

TOTAL EXISTING KW 24.6

REPLACEMENT FIXTURE DATA

4 FOOT

0 1 LAMP @ 37 W/FXT = 0 WATTS
6 1 LAMP W/ REFLECTORS 37 W/FXT = 222 WATTS
0 2 LAMP W/ REFLECTORS 58 W/FXT = 0 WATTS
125 2 LAMP W/ REFLECTORS 58 W/FXT = 7250 WATTS

2 FOOT

0 1 LAMP @ 24 W/FXT = 0 WATTS
0 2 LAMP W/ REFLECTORS 41 W/FXT = 0 WATTS
0 2 LAMP U @ 58 W/FXT = 0 WATTS

8 FOOT

0 1 LAMP W/ REFLECTORS 58 W/FXT = 0 WATTS

TOTAL REPLACEMENT KW 7.5

NET ENERGY SAVINGS 212.4 MBTU/YR

NET DOLLAR SAVINGS \$3,733.97

FORT CAMPBELL ENERGY SAVINGS OPPORTUNITY SURVEY

ECO 6: INDOOR/OUTDOOR LIGHTING EFFICIENCIES TO RECOMMENDED LEVELS

31 AUGUST 1993

PAGE 2 OF 2

EXIT SIGN REPLACEMENT - INCANDESCENT TO LED

BUILDING #: 3202

EXIT SIGNS 7

CURRENT WATTAGE 40

REPLACEMENT WATTAGE 3

HOURS/YEAR 8760

ELECTRIC COSTS:
ENERGY CHARGE \$0.0211 PER KWH
DEMAND CHARGE \$11.78 PER KW

NET ENERGY SAVINGS 7.74 MBTU/YR NET DOLLAR SAVINGS \$84.58

Mon 30 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES

TIME 11:01:30

TITLE PAGE

ENERGY SAVINGS OPPORTUNITY SURVY
FT CAMPBELL, KY
ECO-5: BUILDING 3202

Contract No: 27-93-C-0096

Prepared By: Systems Corp
Estimator: Keith A. Derrington
Estimate Prep. Date: 08/31/93
Current UPB/CSI ID: ORL290

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CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3202EE
4-92

Mon 30 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 3202

TIME 11:01:36

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Mon 30 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
 ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
 ECO-5: BUILDING 3202
 1. BUILDING TO THE 5 FOOT LINE / AA. ELECTRICAL

TIME 11:01:36

DETAILED ESTIMATE

DETAIL PAGE 1

BASE BID

DIVISION 16 ELECTRICAL		QUANTITY	UOM	CREW	MANHR	LABOR	EQUIPMENT	MATERIAL	SALESTX	DIRECT \$
16500 LIGHTING										
16512 7000 FLUORESCENT - RECESSED T8 ELECTRONIC BALLAST										
CD=3 EL 7002	4 FT 1 LAMP PARABOLIC LOUVRE W/ REFLECTOR	*** UNIT COSTS: ***			0.54	17.84	0.07	122.00	6.10	146.01
WC=1100		6.00 EA EELEB		3		107	0	732	37	876
CD=3 EL 7003	4 FT 2 LAMP PARABOLIC LOUVRE W/ REFLECTOR	*** UNIT COSTS: ***			0.59	19.42	0.08	136.00	6.80	162.29
WC=1100		125.00 EA EELEB		74		2,427	9	17,000	850	20,287
16530 1100 SURFACE OR PENDANT MOUNTED										
CD=3 EL 1118	LED EXIT SIGN W/ BATTERY	*** UNIT COSTS: ***			1.25	41.26	0.00	121.45	6.07	168.79
WC=1100		7.00 EA EELEA		9		289	0	850	43	1,181
TOTAL DIVISION 16 ELECTRICAL					86	2,823	10	18,582	929	22,344
TOTAL FACILITY AA. ELECTRICAL					86	2,823	10	18,582	929	22,344
TOTAL BID ITEM 1. BUILDING TO THE 5 FOOT LINE					86	2,823	10	18,582	929	22,344
TOTAL BASE BID					86	2,823	10	18,582	929	22,344
TOTAL ADDITIVE					0	0	0	0	0	0
TOTAL INCL ADD ENERGY SAVINGS OPPORTUNITY SURVY					86	2,823	10	18,582	929	22,344

* * * END OF DETAIL REPORT * * *

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3202E5
 4-94

Mon 30 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 3202

TIME 11:01:36

PROJECT NOTES

SUMMARY PAGE 1

PROJECT NOTES

ECO-5: INTERIOR LIGHTING

SCOPE OF WORK: EVALUATE USE OF HIGHER EFFICIENCY INTERIOR LIGHTING IN
SELECTED FACILITIES AT FT CAMPBELL.

Mon 30 Aug 1993

U.S. ARMY CORPS of ENGINEERS M-CACES
ENERGY SAVINGS OPPORTUNITY SURVY / FT CAMPBELL, KY
ECO-5: BUILDING 3202

TIME 11:01:36

BID ITEM AND FACILITY SUMMARY

SUMMARY PAGE 2

BID ITEM 1 BUILDING TO THE 5 FOOT LINE

BASE BID

ID	FACILITY		COST TO PRM	OVERHEAD	HOME OFC	PROFIT	BOND	OTHER PCTR	TOTAL COST	UNIT COST
AA	ELECTRICAL	1.00 EA	22,344	10.0% 2,234	0.0% 0	7.5% 1,843	2.5% 661	0.0% 0	27,083	27082.65
<hr/>										
BID ITEM TOTAL		1.00 EA	22,344	2,234	0	1,843	661	0	27,083	27082.65
<hr/>										
TOTAL BASE BID			22,344	2,234	0	1,843	661	0	27,083	
TOTAL ADDITIVE			0	0	0	0	0	0	0	
<hr/>										
TOTAL INCL ADD			22,344	2,234	0	1,843	661	0	27,083	

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PROJECT CWE SUMMARY

SUMMARY PAGE 3

ID	BID ITEM	QUANTITY	UOM	BASE BID	ADDITIVE	TOTAL COST	UNIT COST
1.	BUILDING TO THE 5 FOOT LINE	1.00	EA	27,083		27,083	27082.70
TOTAL CURRENT CONTRACT COST				27,083	0	27,083	
Cost Growth from 08/93 to 08/94 Index Values: 0000 0000		0.0%		0	0	0	
ESCALATED CONTRACT COST				27,083	0	27,083	
Government-Furnished Property				0		0	
SUBTOTAL				27,083	0	27,083	
Contingencies		10.0%		2,708	0	2,708	
SUBTOTAL				29,791	0	29,791	
SIOH (S&A)		5.0%		1,490	0	1,490	
CURRENT WORKING ESTIMATE				31,281	0	31,281	

Estimated Construction Time 365 Days

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CONTRACTOR DIRECT SUMMARY

SUMMARY PAGE 4

ID	CONTRACTOR	PM	QUANTITY	UOM	MANHRS	LABOR	EQUIPMENT	MAT	W/TX	AMOUNT	PCT	SUBCON W/OH&P	SUBTOTAL
AA	GENERAL/PRIME		1.00	EA	86	2,823	10	19,511		22,344	100.0%	0	22,344
	TOTAL DIRECT				86	2,823	10	19,511		22,344	100.0%		

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3202E5
4-98

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CONTRACTOR INDIRECT SUMMARY

SUMMARY PAGE 5

ID	CONTRACTOR	PM	SUBTOTAL	*** OVERHEAD *** AMOUNT PCT	HOFC%	**** PROFIT **** AMOUNT PCT	BOND%	OTHER%	***** TOTAL CONTRACT ***** AMOUNT PCT	UNIT COST
AA	GENERAL/PRIME		22,344	2,234 10.0%	0.0	1,843 7.5%	2.5%	0.0%	27,083 100.0%	27082.64
	TOTAL OVERHEAD & PROFIT			2,234 10.0%		1,843 7.5%				

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SI DIVISION SUMMARY

SUMMARY PAGE 6

ID CSI DIVISION	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
16 ELECTRICAL	86	2,823	10	18,582	929	22,344
TOTAL DIRECT	86	2,823	10	18,582	929	22,344

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SYSTEMS SUMMARY

SUMMARY PAGE

ID SYSTEM	MANHOURS	LABOR	EQUIPMENT	MATERIAL	SALES TAX	***** TOTAL * DIRECT
11 INTERIOR ELECTRICAL	86	2,823	10	18,582	929	22,344
TOTAL DIRECT	86	2,823	10	18,582	929	22,344

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3202E5
4-101

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EQUIPMENT SUMMARY

SUMMARY PAGE 8

EQUIP DESCRIPTION	LIFE HRS	TL	HRLY	OWNRSH	OWNS	OVTM	OWNRSH	EXPENSE	HRLY RATE	UPB RATE	HOURS	TOTAL COST
EMI20 SMALL TOOLS									1.40	1.40	7	10
TOTAL PROJECT EQUIPMENT HOURS											7	10

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LABOR SUMMARY

SUMMARY PAGE 9

CRAFT DESCRIPTION	BASE	OVERTM	TXS/INS	FRNG	TRVL	HRLY RATE	UPB RATE	**** HOURS	TOTAL COST
LELEC ELECTRICIANS	20.50	0.0%	24.0%	7.49	0.00	32.91	25.79	86	2,823
TOTAL PROJECT MANHOURS								86	2,823

*** END OF SUMMARY REPORT ***

CREW ID: ORL290

CURRENCY in DOLLARS

PROJECT ID: 3202E5
4-103